People and Language: Defining the Takic Expansion into Southern California

Mark Q. Sutton

Abstract

The geographic distribution of Takic languages across southern California has long begged explanation. Various hypotheses incorporating issues of the timing, origins, and migration direction have been proposed, but no consensus has emerged. Using linguistic, biological, and archaeological data, this study offers a comprehensive model to explain the Takic expansion. It is proposed that a proto-Takic group diverged from Northern Uto-Aztecan (NUA) by about 4,000 BP and that by about 3,500 BP, some of these people (the proto-Gab/Cupan) migrated south to occupy the Los Angeles/Orange County region of coastal southern California, replacing the previous inhabitants, and became the Gabrielino. Sometime between about 1,500 and 1,000 BP, Takic languages diffused to the south and east and were adopted by neighboring Yuman peoples, who developed into the Serrano, Luiseño, Cahuilla, and Cupeño.

Groups speaking Takic languages occupied a portion of southern California at the time of contact (Figure 1), and these languages are related to other languages distributed in the Great Basin to the north and east (Kroeber 1925:578-580). It has long been recognized that these "Shoshonean" groups migrated into southern California from the deserts to the north, but the timing and reasons for such a migration were unknown. It was generally believed that as Takic groups moved south, they created a "Shoshonean Wedge" that split the Chumash to the north and the Yumans to the south. Ideas regarding the timing of the Takic entry range from 6,000 to 1,000 BP, and minimal discussion has focused on the causal factors or mechanisms to account for the Takic expansion. As such, the Takic expansion remains "one of the crucial problems in southern California prehistory" (Warren 1968:9).

This study offers a comprehensive model of the Takic expansion. Six lines of convergent and concordant evidence are presented, derived from linguistics, the archaeological record of coastal and inland southern California, anthropometric and osteometric data on ethnographic and prehistoric populations, respectively, and the results of ancient DNA (aDNA) analysis. Finally, a set of predictions is offered to assist in testing the model.

A History of Views on the Takic Expansion

Kroeber (1923, 1925) was the first to articulate the Takic expansion. Noting the distribution of the "Shoshonean" (or Northern Uto-Aztecan [NUA]) languages across western North America and of the Takic languages across southern California, Kroeber (1923:133, 1925:578-580) suggested that Takic had originated in the deserts to the north and had migrated south into southern California, reaching the coast ca. 1,500 BP. In reaching the coast, the Takic "split" the Yuman and Chumashan groups (Kroeber 1925:579).

Many of Kroeber's contemporaries only briefly touched on the issue. In his treatise on California anthropometry, Gifford (1926a; also see Gifford 1926b) reported the distinct physical differences between some of the Takic groups and their neighbors. He barely hinted at a population movement

when he noted that the archaeological "inhabitants of the southern islands off the Los Angeles coast . . . seem to have their nearest living relatives in the Western Mono" (Gifford 1926a:248). Strong (1929:349) also noted that the "Shoshoneans" came to the coast.

In the 1930s, Rogers (1993:21) observed that the occurrence of cremations indicated a "Shoshonean [Takic] occupation of San Nicolas Island" (see Figure 2) that was stratigraphically superior to the Canaliño (i.e., Chumash) occupation, but interestingly, Alliot (1916) did not report cremations from San Nicolas Island. Rogers (1993:21) believed Takic occupation to have been relatively recent. In addition to cremations, Rogers (1993:21) distinguished the Takic presence by metates, obsidian points, and perhaps sweathouses. Subsequently, in 1937, Winterbourne (1967:47) argued that evidence at the Goff's Island site (CA-ORA-8) (see Figure 2) pointed to a Uto-Aztecan arrival at about 2,000 BP.

Many of the early reviews of southern California prehistory only noted the presence of the "Shoshoneans" (Walker 1951; Meighan 1954; Wallace 1955; True 1966), failing to address the question of migration. In what appears to have been the first comprehensive examination of the issue, Cochran (1965:85) proposed that the "Shoshoneans entered southern California from the Great Basin" and dated that event sometime between about 3,000 and 2,500 BP (Cochran 1965:36). Hopkins (1965:57) envisioned a date

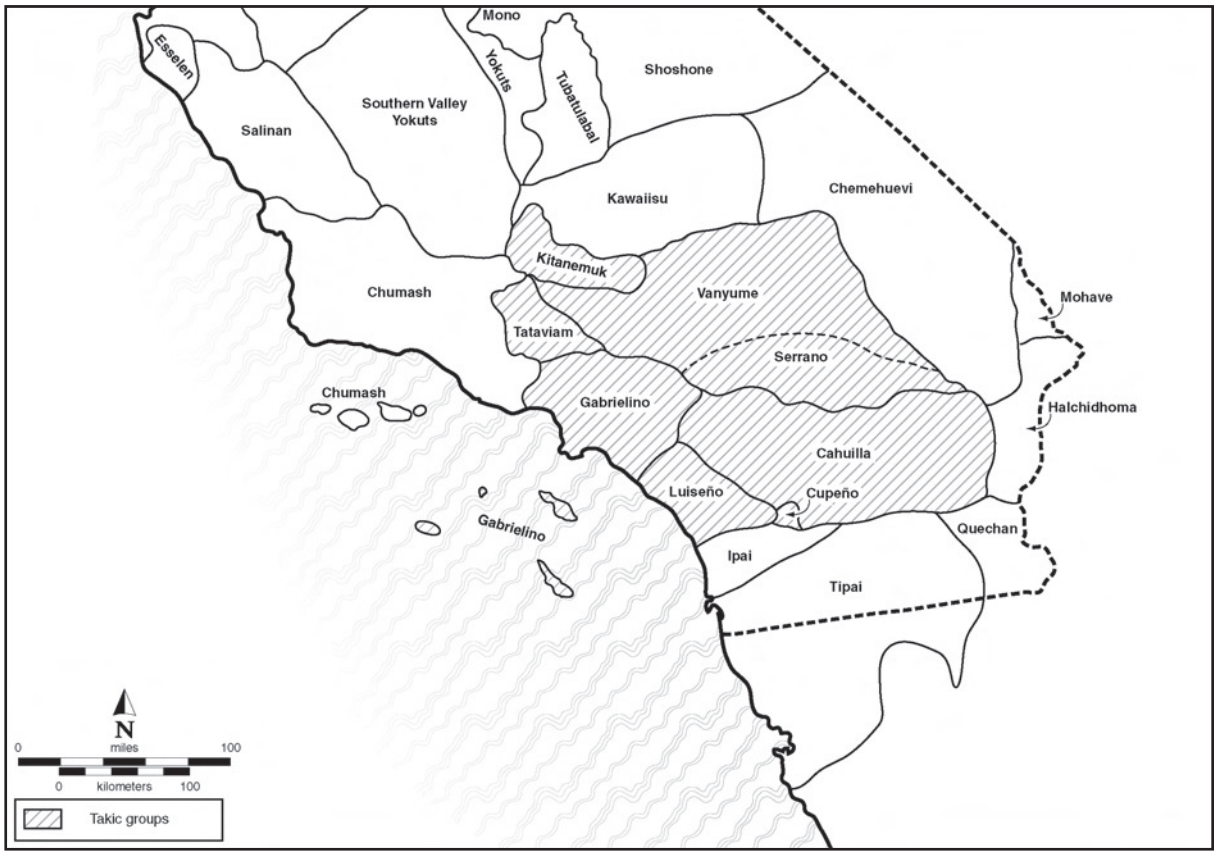

Figure 1. Location of ethnographic groups speaking Takic languages and adjacent groups in southern California (adapted from Heizer [1978:ix] and Ortiz [1979:ix]).

of 4,500 BP for the Takic entry, Rogers (1966:140) suggested 1,000 BP, and Rozaire (1967:330) proposed a date of about 2,550 BP. Warren (1968:4-5) thought that Takic and Yuman groups came to the coast from the deserts ca. 1,300 BP, replacing Encinitas Tradition groups.

Kowta (1969) was the first to integrate the movement of Takic groups into a larger interpretation of southern California prehistory. He proposed that the Shoshonean "intrusion" began about 3,000 BP, which split the coastal and inland Millingstone peoples thereby isolating the inland Millingstone groups (e.g., the Sayles Complex), and arrived on the southern Channel Islands ca. 2,300 BP (Kowta 1969:44, 47-50). This conclusion was based on the cephalic index data of Gifford (1926a) and Rootenberg (1960) and on the archaeological record.

Following the work of Kowta (1969), Ross (1970) suggested that the Takic Luiseño were present in the Irvine area of Orange County about 1,600 BP, and Bull (1977:56, 1983) argued that the ancestors of the Luiseño began to arrive around 2,500 BP. Drover and Spain (1972:43) reported an early (ca. 6,500 BP) flexed inhumation from CA-ORA-64 (Figure 2) associated with a crescent, and they thought it may have represented a new Shoshonean burial type. Based on his examination of the data from Orange County, Koerper (1979:79, also see Koerper 1981:142) placed the date of the Takic entry no later than 2,000 BP.

King (1981:326-327, 1990:199) thought that Takic groups had entered southern California "at the end of the Early period" (ca. 3,500 BP), citing the presence of terminal Early Period beads in "cremation cemeteries" located in Tataviam, Gabrielino, and northern Serrano

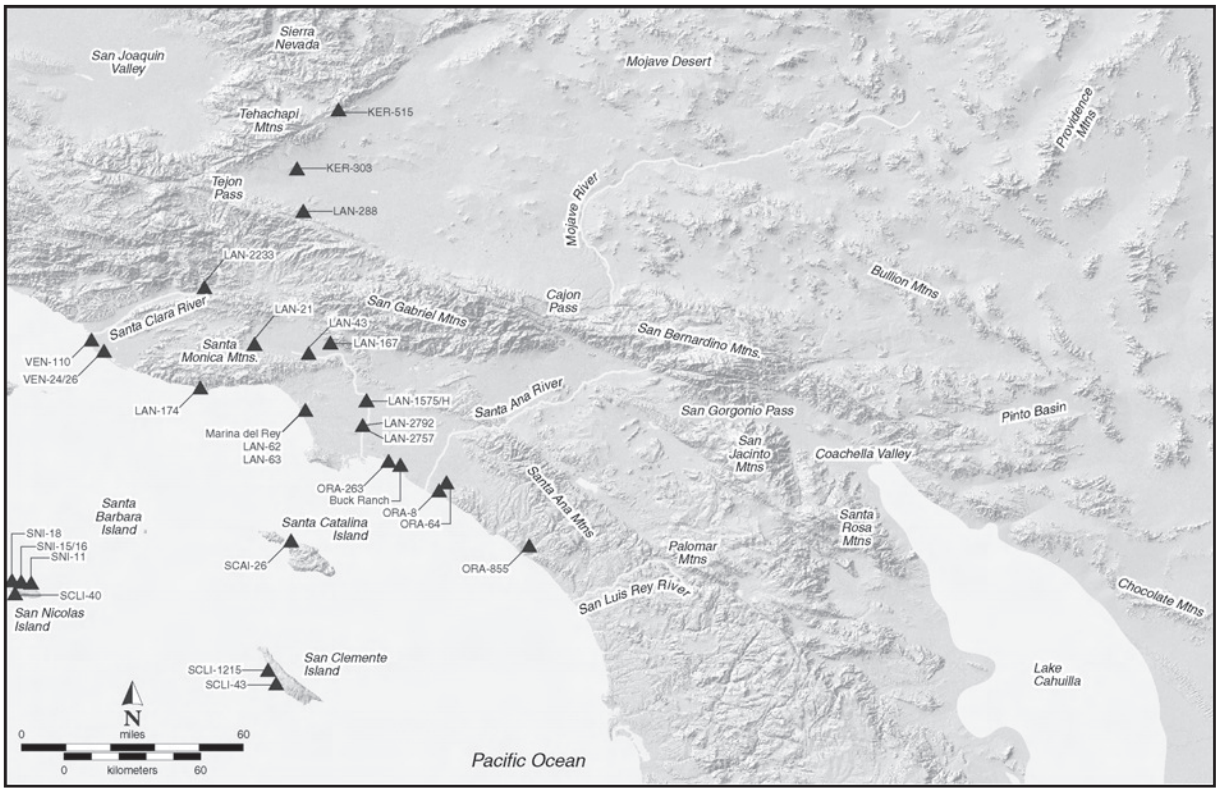

Figure 2. Location of areas and archaeological sites discussed in the text.

areas (following the premise that cremation is a Takic marker, but see below). Synthesizing the then existing data, Moratto (1984:165) suggested that Takic moved into the southern coast between ca. 3,500 and 3,200 BP.

Laylander (1985:29, 51-53) proposed a model of southern California linguistic prehistory, suggesting that Hokan groups had occupied the coast since before 6,000 BP. At about that same time, proto-NUA groups were occupying the western Mojave Desert, the southern Sierra Nevada, and the southern San Joaquin Valley. As Penutian Yokuts groups moved south into the southern San Joaquin Valley about 3,000 BP, Takic folks would have ventured south into southern California, "displacing and absorbing unknown Hokan groups, and beginning internal differentiation" (Laylander 1985:51).

Based on an interpretation of ethnohistoric records, Cottrell (1991) suggested that Takic people never penetrated to the coast of Orange County and that Hokan groups held a 20 km deep strip of the coast until the time of contact. Koerper and Mason (2004) refuted that hypothesis and demonstrated that Takic groups (e.g., the Luiseño) had occupied the coast at the time of contact.

Mason et al. (1997:58, 60) interpreted the widespread changes at ca. 3,000 BP that marked the inception of the Intermediate Period as evidence of the Takic arrival. Grenda and Altschul (2002:128) and Altschul et al. (2005:291, 295, 2007:35) argued that there had been at least several migrations of desert peoples to the coast during the Holocene, and they suggested that the sudden influx of people in the Marina del Rey area (Figure 2) about 3,000 BP was probably the Takic. Golla (2007:74-75; also see Hill 2001) thought that 3,500 BP was too early for a divergence of Takic (but noted that not all linguists agree), and he suggested it was more likely around 2,000 BP.

Most recently, Kennett et al. (2007) proposed that Uto-Aztecans arrived along the southern California coast and occupied the southern Channel Islands sometime around 5,000 BP. They based their argument on the presence of *Olivella* Grooved Rectangle (OGR) beads dating to about 5,200 BP, which some scholars (e.g., Howard and Raab 1993; Raab and Howard 2002) take to be NUA markers. Kennett et al. (2007) also pointed to biological data indicating a population replacement on San Clemente Island.

Investigating Linguistic Prehistory

The linguistic prehistory of California has been examined by a number of researchers (e.g., Moratto 1984; Laylander 1985; Hughes 1992; Golla 2007) using a variety of data sets. The movement of a language is often equated with population movement, but languages can also diffuse without an actual population movement. The major lines of evidence used in migration studies are linguistic, biological, ethnographic, historical, and archaeological (see Rouse 1958, 1986; Harding 1974:8; Anthony 1990; Sutton 1991; Burmeister 2000). The types of linguistic evidence used to establish migrations were outlined by Sapir (1916), Dyen (1956), Swadesh (1964), and Kinkade and Powell (1976:84-85). These include language distributions, original homelands, loanword patterns, lexical reconstructions, placenames, and oral tradition.

If a new population enters an area and replaces an existing population, one would expect that this would be reflected in the biological data of that region. Population differences could be based on skeletal anthropometry, blood groupings, antigen groupings, aDNA, and/or other traits. Such studies require large samples and firm chronological control, luxuries that archaeologists rarely enjoy.

If a population replacement had taken place fairly recently, evidence of that migration may be present in ethnohistorical records (e.g., Sutton 1986) and/or oral tradition (e.g., Sutton 1993a; Laylander 2006). Written

records form the best evidence for the migration of peoples, such as the migrations of Euroamericans across North America after A.D. 1492. Unfortunately, there are few historical records relevant to those migrations that interest prehistorians.

The archaeological expectations of a population replacement would include possible changes in technology, mortuary patterns, settlement patterns, and subsistence practices. Such changes and patterns in southern California are difficult to detect given that many sites are not firmly dated and that our understanding of southern California prehistory is limited.

The Evidence for a Takic Expansion

The major lines of evidence regarding the Takic expansion include linguistic, biological, ethnographic, and archaeological data. Each is discussed in turn below.

The Linguistic Evidence

What is now known as Takic in southern California was originally called the "Southern California" branch of the Shoshonean language family (e.g., Kroeber 1907:97). This language grouping was later reclassified as the Luisenic branch of NUA (Lamb 1958:96), then as "Old Californian" (Nichols 1981), and is currently called Takic (e.g., Miller 1984, 1986).

It is generally believed (Lamb 1958; Sutton 1987; Madsen and Rhode 1994; Campbell 1997:133; Silver and Miller 1997:290; Golla 2007) that sometime before about 5,000 years ago, Uto-Aztecan was located in northern Mexico and split into its northern (NUA) and southern (Southern Uto-Aztecan [SUA]) divisions at that time. The history and movement of SUA is beyond the scope of this paper (refer to Hill [2001]), but some SUA languages are present in the American Southwest, including Pima/Tohono Oo'dham.

The classification currently employed for NUA (e.g., Hinton 1991) includes four major branches; Hopic, Tubatulabalic, Takic, and Numic. A widely held model of NUA prehistory suggested that NUA moved into the general area of the southern Sierra Nevada/western Mojave Desert (Fowler 1972, 1983) by about 5,000 BP. The NUA family would have subsequently diverged into its branches sometime between 4,500 and 3,000 BP (Hinton 1991:135) (Figure 3). By about 3,000 BP, Hopic would have gravitated toward the Southwest (Sutton 2000), Tubatulabalic (consisting of only one language, Tubatulabal) would have settled in the southern Sierra Nevada, and Takic would have diverged and expanded. Numic would have remained in place until its expansion about 1,000 BP (see Madsen and Rhode 1994; Sutton 1994). Hill (2001:928-929) thought these dates were too early and suggested that proto-NUA did not enter California until after ca. 4,500 BP and did not break up until closer to 3,000 BP. Golla (2007:75) suggested that Takic diverged about 2,000 BP and moved south to occupy most of southern California "in a series of relatively late expansions from the northeast" (Golla 2007:74).

Taking a different tack, Miller (1984:13) argued that NUA did not exist as a single language classification and that Numic, Tubatulabalic, Hopic, and Takic were each coordinate with SUA. Miller (1984:16, 18) further argued that Takic and Tubatulabalic were linguistically very close.

Hill (2006, 2007) agreed that Takic and Tubatulabalic were linked and proposed that Tubatulabalic should be classified within a broader Takic that was divided into two sub-branches: (1) Tubatulabal/Serran and (2) Gabrielino/Cupan. This new classification (Hill 2007) seems to be concordant with the geographic position of Tubatulabal in the southern Sierra Nevada adjacent to the San Joaquin Valley and the possible presence of proto-Takic in the southern San Joaquin Valley (e.g., Klar 1977:164; Shaul 1982:209-210; Moratto 1984: Figure 11.7; Eshleman and Smith 2003; Kennett et

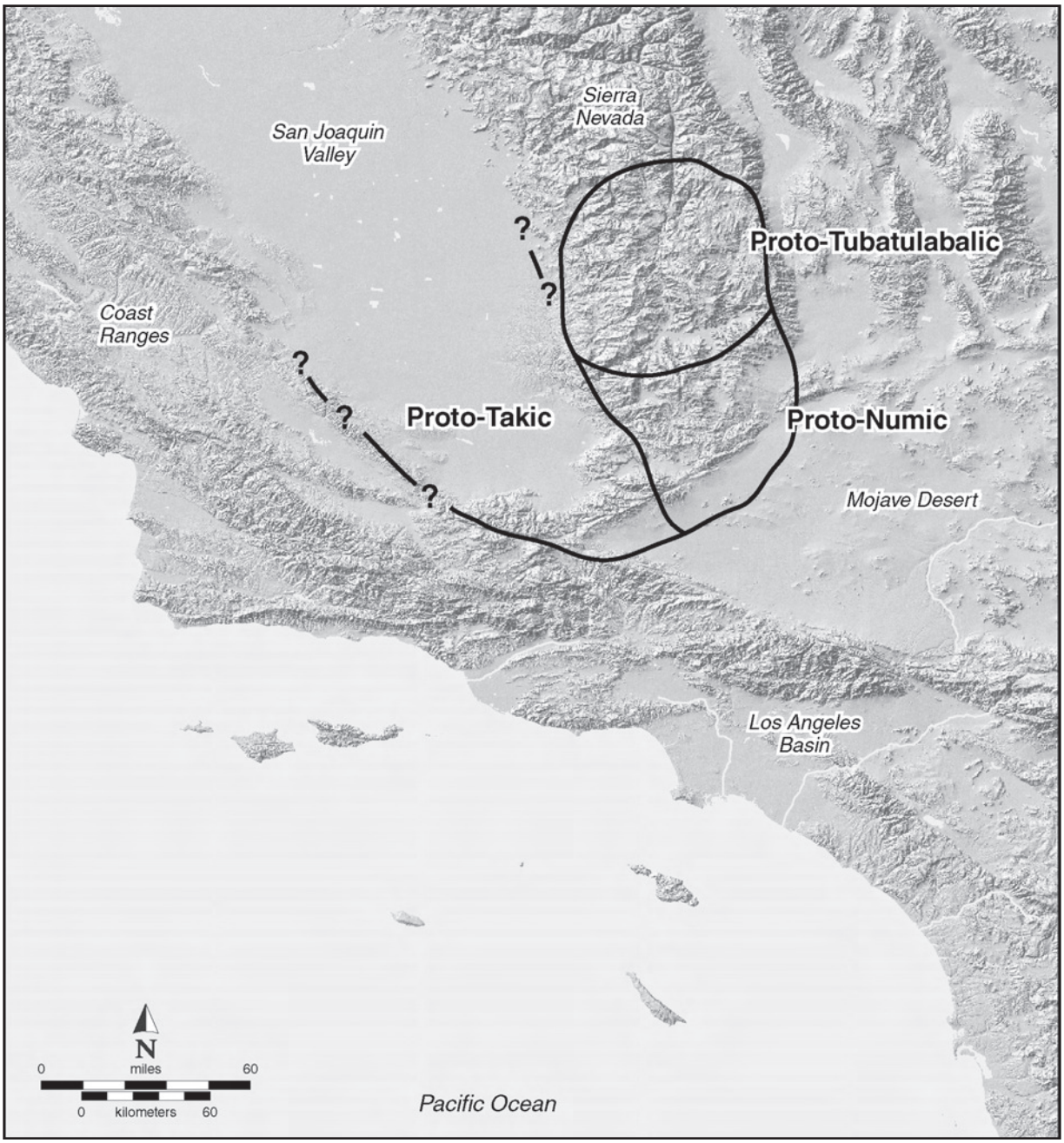

Figure 3. General location of the (traditionally defined) branches of Northern Uto-Aztecan in California about 3,500 BP.

al. 2007). Tubatulabal appears to be "an older idiom" than the other NUA languages (Shipley 1978:88), and it is possible that it is a "relic" Takic language still in place in the northern portion of the original Takic homeland. The issue of whether Tubatulabal is a Takic language is well beyond the scope of this paper (but see Sutton 2009).

The Takic Homeland

Whatever the specific classification, the various NUA branches (all but Hopic) are in very close proximity in the southern Sierra Nevada, San Joaquin Valley, and western Mojave Desert (see Figure 3), including three of the six Numic languages and two (or three) of the seven Takic languages. This distribution is strong evidence that this region was the original homeland of the NUA branches and center of NUA divergence and dispersal (following the "center of gravity" postulates of Sapir [1916] and noted by Lowie [1923:147]; also see Voegelin [1958:49] and Foster [1996:64-65]). Using independent ethnobiological and linguistic evidence, Fowler (1972, 1983; also see Miller 1984:20) suggested that the Numic homeland was in the southern foothills of the Sierra Nevada. Nichols (1981:8) agreed with Fowler about the general location of the Numic homeland and suggested that the homelands of Tubatulabalic and Takic were in that same general region. Nichols (1981) further argued that the region was the source area for the dispersal of all the NUA branches.

The Takic (or perhaps NUA) homeland may have been larger than originally thought. Based on "old" linguistic ties between Esselen (on the central coast) and Takic, it is possible that proto-Takic may have also occupied the southern San Joaquin Valley, perhaps as early as the Middle Holocene (e.g., Klar 1977:164; Nichols 1981; Shaul 1982:209-210; Moratto 1984: Figure 11.7; Kennett et al. 2007). Data on aDNA from the San Joaquin Valley (Eshleman and Smith 2003, 2007:293-295; also see Kennett et al. 2007) lend additional support to this idea as aDNA from three burial populations in the Central Valley dating between 3,600 and 1,800 BP shows greater haplogroup affinities to Takic groups and not Penutians, with some indication of "mixing" during Windmiller times.

Linguistic Divisions and Distributions within Takic

The traditional view is that the Takic branch consists of seven languages (not including Vanyume, Fernandiño, and Juaneño) (Goddard 1996; Campbell 1997). Kroeber (1907:99-100) divided Takic into three sub-branches, Serrano, Gabrielino, and Luiseño-Cahuilla (also see Munro 1990:Figure 1; Hinton 1991:Table 1). These original three sub-branches are now generally classified into two, Serran and Cupan (Shipley 1978:90; Goddard 1996:Table 3; but see Miller 1984:16-17). Cupan was further divided into two groups, one consisting of Cahuilla and Cupeño and one of Luiseño (and Juaneño) (e.g., Munro 2002:667). Hill (2007) also divided Takic into two sub-branches (see Figure 4), including Serran and Gabrielino/Cupan, and this model is followed herein. Of note is the fact that the Serran sub-branch is generally in the northern portions of Takic territory while the Cupan sub-branch is generally in the south.

The Serran Sub-Branch of Takic

The Serran sub-branch of Takic consists of Kitanemuk, Serrano (including Vanyume), and Tataviam. Kitanemuk is the northernmost Takic language (pending a reevaluation of Tubatulabal), and its territory is contiguous with that of the Kawaiisu, who spoke a Numic language (Kroeber 1925:Plate 1; Blackburn and Bean 1978:564). Kitanemuk territory is also geographically close to the Tubatulabal, separated only by the Kawaiisu. Further, Kitanemuk is still in place within the region thought to be the Takic homeland (Fowler 1972, 1983; Nichols 1981). Kitanemuk and Serrano are linguistically very close

and geographically contiguous (see Figure 1). Gifford (1918:215) referred to the Kitanemuk as the "northwest Serrano," reflecting the close linguistic relationship between these two groups.

Tataviam is south of and contiguous with Kitanemuk and far western Serrano (King and Blackburn 1978). Chumash is immediately to the west (see Figure 1). The linguistic classification of Tataviam has long been an issue. Bright (1975:230) thought that Tataviam was a separate language showing Takic affinities, but also suggested that Tataviam might be an isolated remnant, "influenced by Takic, of a language family otherwise unknown in southern California" (Bright 1975:230; also see Shipley 1978:88; Hudson 1982:228). Beeler and Klar (1977:296) were not convinced that Tataviam was Takic, arguing instead that it was a Chumash dialect. They noted, however, that Tataviam had many borrowed words from Kitanemuk and had the "strongest identifiable influence" from Kitanemuk (Beeler and Klar 1977:299). The current view is that Tataviam is a Takic language (King and Blackburn 1978:535; Goddard 1996; Campbell 1997; also see Johnson and Earle 1990). The specific relationship between Tataviam and the other Takic languages remains unresolved.

The Cupan Sub-Branch of Takic

The Cupan sub-branch is divided into two major groupings, Gabrielino and Cupan (see Figure 4). The Gabrielino grouping consists of one language, Gabrielino. Unfortunately, very few linguistic data are available for Gabrielino. Some researchers (Goddard 1996:Table 3; Munro 2002:667) argued that Gabrielino belonged in the Serran sub-branch, but others (Bright 1975: Bean and Smith 1978a:538; Hill 2007) placed Gabrielino within the Cupan sub-branch. Gabrielino and Fernandeño dialects are essentially the same language (but given different names according to the locations of the Missions), called Gabrielino (Kroeber 1925:620). Gabrielino was also spoken on Santa Catalina Island and probably on San Clemente Island as well (Kroeber 1925:620).

It is possible that an isolated Gabrielino dialect (Nicoleño) was spoken on San Nicolas Island, an assessment based on a few words and songs recorded from a single female individual, who was considered the last survivor on San Nicolas Island (Kroeber 1907:153). Alternatively, it was suggested that the woman may have been native Alaskan (Daily 1989).

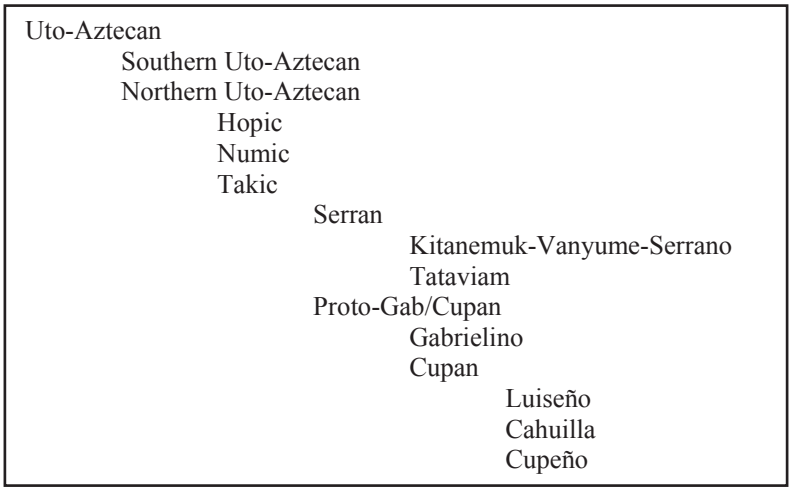

Figure 4. The internal classification of the Takic branch of Northern Uto-Aztecan (following Hill [2007]).

The Cupan grouping consists of Cahuilla, Cupeño, and Luiseño (Juaneño is considered linguistically the same as Luiseño [White 1963:91; Bean and Shipek 1978], the two artificially divided by the Spanish). Bright and Hill (1967:362; also see Seiler 1967; Hill and Hill 1968:236; Jacobs 1975:5; Miller 1984:16-17) proposed that proto-Cupan first split into proto-Cahuilla-Cupeño and Luiseño, after which proto-Cahuilla-Cupeño split into Cahuilla and Cupeño.

The languages of the Cupan grouping are more closely related to Gabrielino than to the neighboring Serrano, suggesting to Golla (2007:75) that the bulk of Cupan "probably originated on the southern and eastern borders of Gabrielino territory and expanded southward along the coast and eastward through San Gorgonio Pass" (Figure 2). If so, Gabrielino would have been in place prior to any further movement of proto-Cahuilla-Cupeño south or east.

The biological and archaeological data suggest that proto-Gab/Cupan arrived in southern California sometime about 3,500 BP. It would have come from the north, perhaps sharing a common origin with proto-Serran (see Figure 4). Being in place in southern California for several thousand years prior to an expansion of Cupan, Gabrielino may have been a "jumping off point" to a differentiation of Proto-Cupan.

Discussion

The linguistic data regarding the Serran sub-branch are quite limited but are better for the Cupan sub-branch. It seems clear that the Takic homeland was in the northwestern portion of ethnographic Takic territory and that at least some Takic language grouping moved south from there. It is suggested herein that proto-Gab/Cupan was the Takic linguistic entity that moved south, probably from the southern San Joaquin Valley, and occupied the Los Angeles/Orange County region beginning about 3,500 BP. It is not clear who the incoming Takic group may have replaced. Bright and Bright (1969:21-22) noted that since Gabrielino and Luiseño borrowed words that are not Hokan, Takic (proto-Gab/Cupan) may have replaced a language that was neither Chumashan nor Yuman but one or more languages belonging to a now-extinct language family. Laylander (1985:40) suggested that this may have been a non-Yuman Hokan language. On the other hand, Hinton (1991:138-139) argued that Yuman developed *in situ* in southern California and further noted that there was "virtually no evidence of Yuman influence on Gabrielino" (Hinton 1991:148). This suggests that the movement of proto-Gab/Cupan was a population migration rather than just a language movement and implies that proto-Gab/Cupan replaced a Yuman language, as was argued by Hinton (1991:136-137).

For the proto-Cupan grouping of languages, Hinton (1991:133) thought that Cupan and California Yuman had converged to be very similar phonologically and that Yuman had a "major influence" on Cupan languages (Hinton 1991:148). Further, Hinton (1991:148) argued that there was "strong evidence that Yuman languages existed earlier in the area now occupied by the Cupan," that contact between Diegueño and Cupan "is relatively recent" (Hinton 1991:152), and that "Yuman influence on Takic is of greater time depth than the contact with the Diegueño" (Hinton 1991:152). Hinton (1991:154) further suggested that River Yuman had a greater influence on Cupan languages than did other Yuman languages but that Diegueño had greater influence later (Hinton 1991:154). Finally, Laylander (2006:156, Figure 2) reported the use of "foreign or archaic language" (non-Takic language elements) in oral tradition among the Luiseño, Cupeño, and Cahuilla (all Cupan groups), but not among the Kitanemuk, Tataviam, and Serrano (all Serran groups) or Gabrielino, again suggesting some retention of a former language among Cupan.

Golla (2007:75) saw more linguistic difference within the Serran (northern) sub-branch (Kitanemuk, Serrano,

and Tataviam) than the Cupan (southern) sub-branch, "making it likely that ethnographic Cupan territory reflects a fairly recent Uto-Aztecan intrusion, probably within the last millennium." He also thought that Cupan languages were closer to Gabrielino than Serrano and that the Cupan languages diverged from Gabrielino and spread south along the coast and then east (Golla 2007:75) . Moreover, he suggested that as Yuman linguistic traits were present in Cupan languages, the areas occupied by Cupan languages were former Yuman areas (Golla 2007:75) .

Kitanemuk and Serrano are linguistically very close and geographically contiguous, with Serrano occupying a larger territory to the east (see Figure 1). Gifford (1918:215) referred to the Kitanemuk as the "northwest Serrano." Given that Kitanemuk is within the presumed Takic homeland and in geographic contact with other NUA branches and Serrano is not, it seems likely that Kitanemuk is older and that Serrano and Vanyume derived from Kitanemuk. Kitanemuk is also geographically contiguous with Chumash and archaeological data suggest that this has been the case for at least several thousand years (Sutton 1980, 1988; Warren 1984:423).

The Vanyume are generally considered a branch of the Serrano (Kroeber 1907:139-140, 1925:614), although their affiliation is poorly understood. Bean and Smith (1978b:570) reported that the Vanyume were politically separate from the Serrano. Kroeber (1925:614) observed that the Vanyume dialect was "nearer to the Kitanemuk than to the Serrano proper" but that "all three idioms [Kitanemuk, Vanyume, and Serrano] appear to be largely interintelligible." These linguistic data suggest a gradation of Kitanemuk/Vanyume/Serrano (also see Earle 1990:101) and hint at the possibility that Vanyume split from Kitanemuk, after which Serrano split from Vanyume. Another possibility is that the Vanyume were actually a branch of Kitanemuk (both in the Mojave Desert) rather than of the Serrano (in the San Bernardino Mountains).

In sum, the linguistic data support the hypothesis that a Takic population (the proto-Gab/Cupan) entered coastal southern California but does not provide any good evidence of the timing of that migration. No information regarding the disposition of Tataviam is available, and there is no evidence of any movement of Kitanemuk. There is evidence indicating that the Cupan languages derived from Gabrielino, suggesting that Gabrielino was in place in coastal southern California prior to the divergence of Cupan. Other data support this general timing of the divergence of Cupan as well, and it appears Cupan replaced Yuman languages.

The Biological Evidence

Among the best evidence of any population movement is biological differentiation. If a new population moves into an area, they should be biologically distinct from their predecessors. These differences would be manifested in metric, nonmetrics, and aDNA data.

Metric Data

If a distinct population of Takic people entered southern California and replaced an existing, non-Takic (e.g., Yuman) group, one would expect evidence that a new physical type replaced an earlier physical type. As the Takic occupied much of the southern California region at contact, the ethnographic physical type would likely have replaced an archaeological physical type if a population movement had occurred sometime in prehistory. If language diffused, but populations did not, no new physical type would be expected. Several lines of metric data exist to test the population movement/replacement and language movement models, and they are discussed below.

Cephalic and Cranial Index Data

Skull shape falls mostly into three basic categories: brachycephalic (short headed), mesocephalic

(medium headed), and dolichocephalic (long headed). A determination of head shape is made by measuring the breadth of the skull, dividing by the length of the skull, and multiplying by 100. The resulting index is used to place the skull into one of the categories (Bass 1987:69). For living people, this is called the cephalic index (CI), and for skeletal populations, it is called the cranial index. In using these indices, there are issues of sample size and methods, as pointed out by Titus (1987:8, 10) regarding Gifford's (1926a) data. Further, skull shape is a complex interaction of genetic and environmental factors (Larsen 1997:227), and it should be used judiciously as an ethnic marker.

Based on cephalic index determinations of California Indians, Gifford (1926a:224, 1926b; also see Carr 1880; Boas 1895, 1905:356-357) identified three basic physical "types" of California Indian peoples; Yuki, Californian, and Western Mono (see Figure 5). The Yuki type is confined to northwestern California and is not considered further here. The most common and widespread type, called Californian, has a CI greater than 81 (mesocephalic to brachycephalic). The third physical type, called Western Mono, has an average CI of 76 (dolichocephalic) and is quite uncommon in California.

Gifford (1926a:241) also identified seven archaeological cranial types in California. In southern California, these included the Santa Barbara type (also see Rogers 1929:422-438) along the Santa Barbara coast and the northern Channel Islands (the Chumash region) and the Santa Catalina type "on Los Angeles and more southerly coast and southern [Channel] islands" (Gifford 1926a:241), essentially the area occupied by the ethnographic Gabrielino (Tongva). The Santa Barbara type had an average cranial index of 78 while the cranial index for the Santa Catalina type was 72 (Gifford 1926a:Table 32). Gifford (1926b:52) reported that the "extinct Santa Catalina islanders" had an average cranial index of 74. He further reported that the archaeological "inhabitants of the southern islands off the Los Angeles coast . . . seem to have their nearest living relatives in the Western Mono" and equated the Santa Catalina cranial type to the Western Mono physical type (Gifford 1926a:248, 251).

Gifford (1926a:Map 2) combined the CI and cranial index data to show the distribution of cephalic index types in California. In southern California (Figure 6), the Californian type is represented by the Takic Cahuilla, Serrano, Luiseño, and Cupeño, the Yuman Diegueño, Mohave, Cocopa, and Yuma, and at least some Chumash (Gifford 1926a:Table 7). Interestingly, the Cahuilla, Serrano, Luiseño, and Diegueño all fell within the narrow-nosed subtype of the Californian type (Gifford 1926a:Table 3), suggesting an even closer relationship. The distribution of the Western Mono type in southern California is limited to just the Takic Gabrielino, the only other recorded Western Mono type groups being the Western Mono and the Tubatulabal (both Northern Uto-Aztecan groups) to the north of southern California. There were no data reported by Gifford (1926a) for the Kitanemuk or Tataviam.

Subsequent archaeological investigations in southern California have added to the cranial index data base. On San Nicolas Island (see Figure 2), early crania from CA-SNI-40 (Reinman and Townsend 1960:29) had cranial indices between 76 and 81 (Rootenberg 1960:Table 2) while the data from the later CA-SNI-18 site (Reinman and Townsend 1960:29) ranged from 69 to 76 (Rootenberg 1960:Table 2). Titus (1987:15-16) further reported that the crania from CA-SNI-15 and -18 (dated to about 300 BP) were of the Western Mono type while the crania from CA-SNI-16 (dated between ca. 3,700 and 3,300 BP; Lauter 1982:32) and CA-SNI-56 were of the Californian type. These data suggest that a population with a Western Mono cranial index type replaced a population with a Californian cranial index type sometime after ca. 3,300 BP. Gifford (1926a:248, Table 36) reported a cranial index on San Nicolas Island of 76, slightly larger than on the

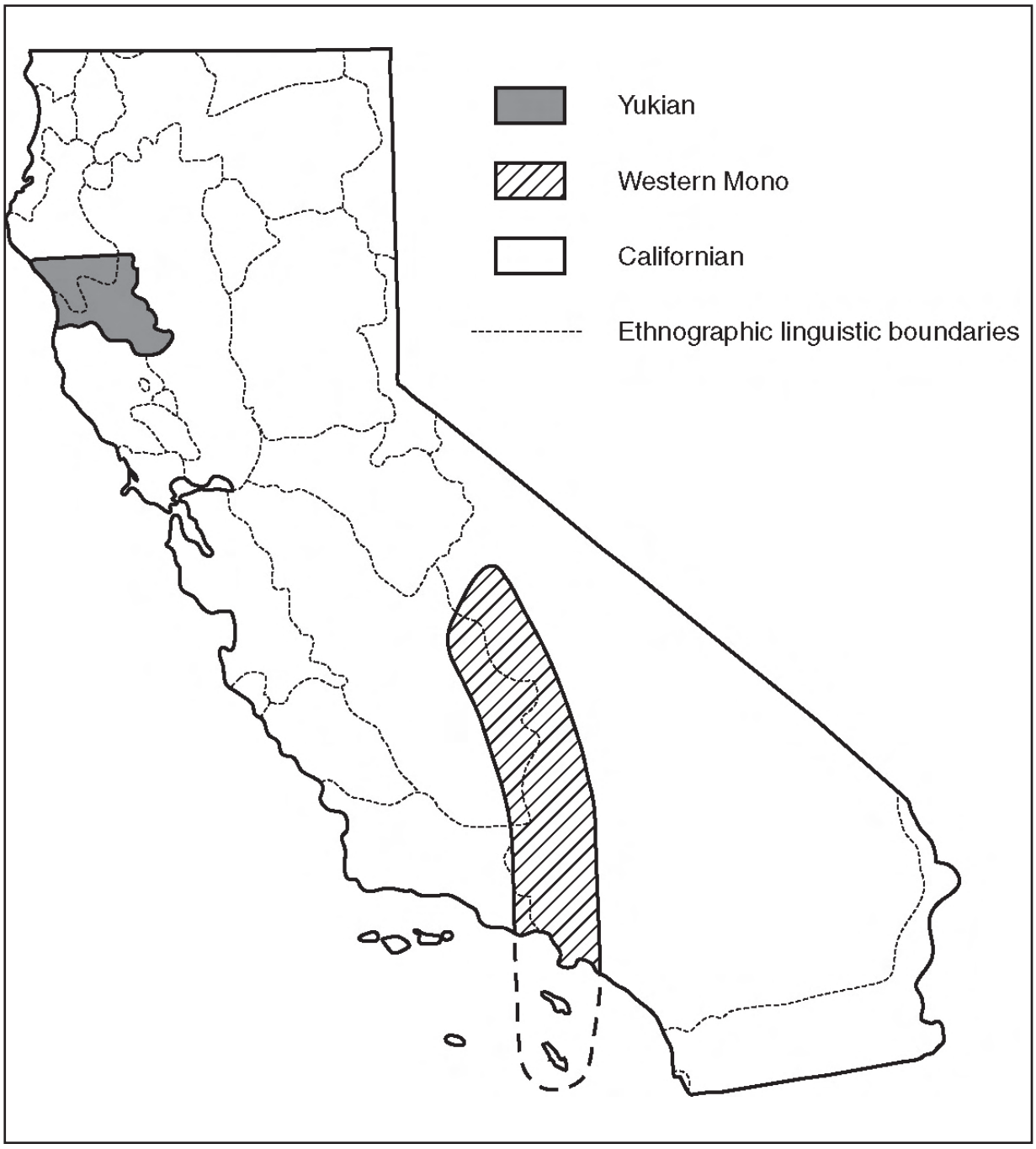

Figure 5. The geographic distribution of California Indian physical types (after Gifford 1926b:58) with linguistic boundaries after Kroeber (1925).

other southern Channel Islands, hinting at a greater biological affinity to the Chumash and suggesting that the Western Mono type arrived on San Nicolas Island a bit later than on the other southern Channel Islands. Indeed, using a variety of bioarchaeological data sets, Ezzo (2002:86; also see Hawley 2001:27, 37, Table 5) concluded that it was "clear that San Nicolas Island was occupied by at least two very distinct phenotypic groups," the earlier of which was replaced by an "ethnically distinct population ancestral to the Gabrielinos."

The data from Santa Catalina Island are limited. Excavations at the Ripper's Cove site (CA-SCAI-26; Reinman and Eberhart 1980; see Figure 2) revealed a late occupation (radiocarbon dated after ca. 800 BP; Reinman and Eberhart 1980:Table 1). Four burials were recovered from Ripper's Cove, and the two from which measurements could be obtained were both dolichocephalic (Western Mono type) (Salls 1984:21, 26).

On San Clemente Island, cranial index data from Eel Point (CA-SCLI-43; see Figure 2), dating prior to 3,000 BP, fell within the Californian type, while those from the later Nursery site (CA-SCLI-1215; see Figure 2) were of the Western Mono type (Titus 1987:15). Titus (1987:1) suggested that on San Clemente Island, there was a population replacement of "an earlier Hokan speaking population by Uto-Aztecan speaking Shoshonean people." It was further suggested (Titus and Walker 2000:81) that people of the Californian

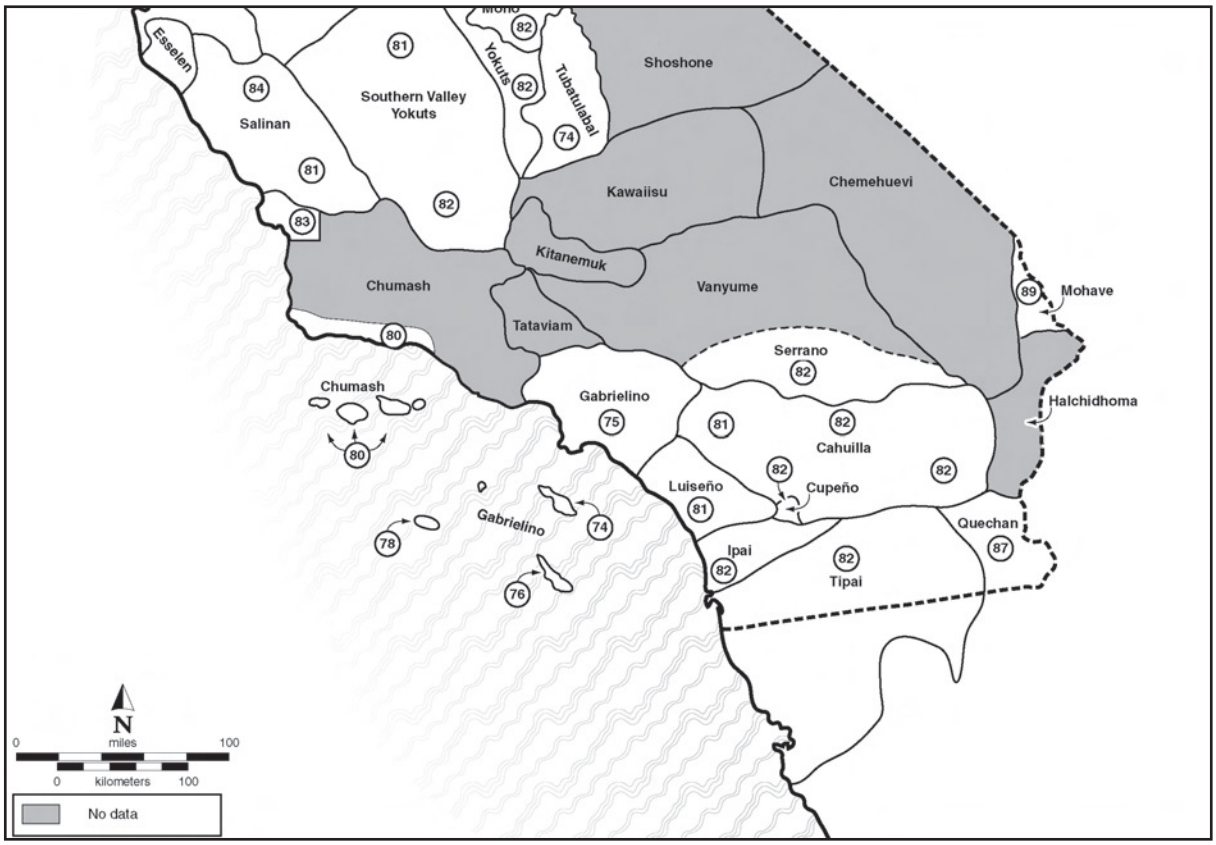

Figure 6. The distribution of cephalic and cranial indices of native peoples in southern California as reported by Gifford (1926a: Map 2). Multiple measures within a group reflect measurements of the subgroups defined by Kroeber (1925). Group names reflect the current usages, rather than those used by Gifford and Kroeber.

type lived on both the northern and southern Channel Islands and that people of the Western Mono type replaced those of the Californian type on the southern Channel Islands. Potter (1998:18, Table 9) interpreted the same data set as suggesting that the incoming Takic groups may have interbred with the existing Hokan (e.g., proto-Yuman) groups rather than simply replacing them and suggested that a model of "small waves of Shoshonean groups migrating into the L.A. basin and interbreeding with the occupying Hokan groups may be appropriate."

More extensive studies of skeletal metric and non-metric traits from the Santa Barbara mainland and both the northern and southern Channel Islands have recently been conducted (Kerr and Hawley 2002; Kerr et al. 2002; Kerr 2004), using both existing data (e.g., Titus and Walker 1986) and new data from San Nicolas Island. Given the small overall sample size from the southern Channel Islands, the various samples from San Nicolas were combined into two temporal units, 6,000 to 2,500 BP and 2,500 BP to the historic era (Kerr and Hawley 2002; Kerr 2004), or before 3,000 BP and after 3,000 BP (Kerr et al. 2002). Using the San Nicolas data, Kerr and Hawley (2002:Figure 5) documented a shift from the Californian type to the Western Mono type through time, a pattern repeated for the southern Channel Islands in general (Kerr and Hawley 2002:Figure 4; also see Kerr et al. 2002:Figure 6) (Figure 7). There was no evidence of a change through time in the northern Channel Islands (Kerr and Hawley 2002:Figure 4; Kerr et al. 2002:Table 19). Some of the site samples exhibited mixed cranial index values, suggesting to Kerr and Hawley (2002:551; also see Kerr 2004:98) that the earlier (Hokan?) and later Takic groups may have commingled.

Kerr (2004:94-98, Figures 6.1 and 6.3, Table 6.2) reinforced this conclusion, noting that both mean cranial

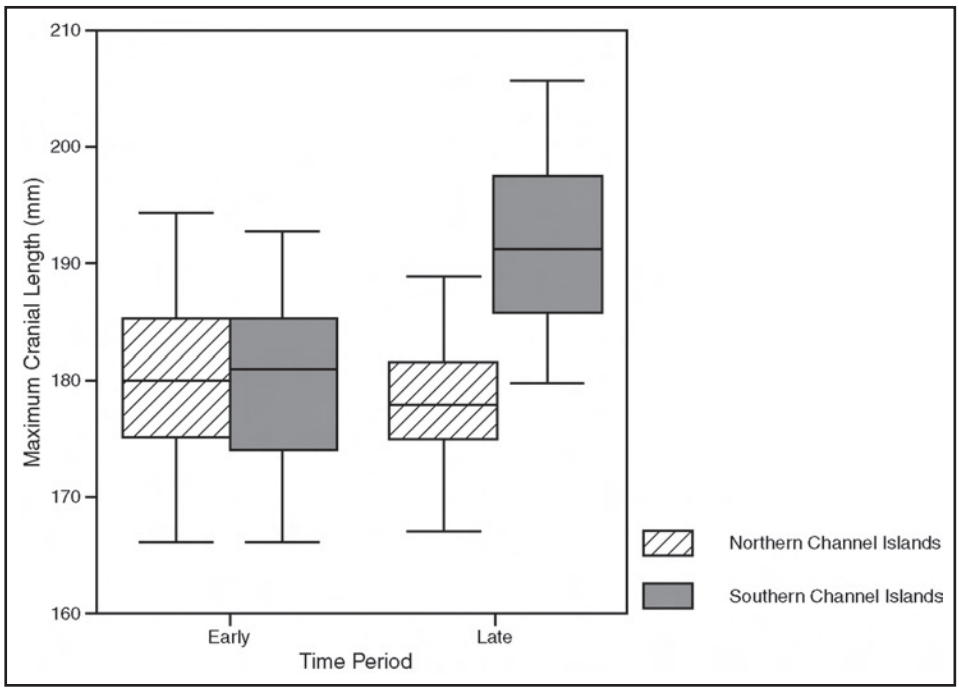

Figure 7. The cranial length data for the southern Channel Islands, showing the shift from the Californian type (mesocrany) to the Western Mono type (dolichocrany) through time (adapted from Kerr and Hawley [2002:Figure 4]).

lengths and breadths changed from the Early Period to the Late Period on the southern Channel Islands but that no change was seen in the northern Channel Islands. Kerr (2004:127, 133) concluded that there had been a population replacement on the southern Channel Islands but not on the northern Channel Islands and observed that the craniometrics of the late southern Channel Islands populations were very similar to those of late populations along the southern California coast and in the Great Basin. She also suggested that the new population (the Takic) arrived on the southern Channel Islands sometime between 4,000 and 2,500 BP, more specifically between 3,000 BP and 2,500 BP (Kerr 2004:132-133, 139, 167).

While the craniometric data on the southern Channel Islands clearly support a population replacement, there are fewer data from mainland sites. In the Chumash area, cranial index data indicate the presence of a Californian type (e.g., Carter 1941:Table 1). The cranial index data from the Zuma Creek site (CA-LAN-174; Peck 1955; see Figure 2), which was dated to the Middle Holocene, ranged from 69 to 81, but four of the six burials had cranial indices over 75 (Littlewood 1960:147), suggesting more of a Californian type.

In ethnographic Gabrielino (Tongva) territory, several data sets are available. A collection of 29 individuals excavated from the Buck Ranch site (Figure 2) in Huntington Beach in 1930 and 1931 (see Chace 2008) was analyzed by Mooney (1971). This site dated to the Late Period (ca. after 1,500 BP) and contained a burial ground with perhaps 100 individuals. Cranial indices were obtained on 25 individuals, and a median cranial index of 74.5 was determined (Mooney 1971:3). This cranial index is comfortably within the range of the Western Mono type, and it fits the ethnographic Gabrielino.

The Late Period village of *Yaanga*? (CA-LAN-1575/H; Goldberg 1999; see Figure 2), located along the Los Angeles River near downtown Los Angeles, contained a small cemetery with 14 inhumations and five cremations. The cranial index of the four measured individuals averaged 68.8 (Goldberg 1999:138), a result that was described as "very Gabrielino" (Western Mono type). Goldberg (1999:155) argued that "the presence of very Dolichocranic individuals in this cemetery dating to at least 1,000 years ago provides very strong evidence of the Uto-Aztecan incursion to the coast by that time."

A small cemetery (CA-LAN-2792; Mirro et al. 2005; see Figure 2) discovered near Compton contained 10 flexed burials and was dated between 960 and 510 BP. Burial 1, a female, had a cranial index of 77.89 (Mirro et al. 2005:85). Finally, a late burial ground at the Peck Site (CA-LAN-62/H; Altschul et al. 1992:339; Koerper et al. 2008; see Figure 2) near Marina del Rey contained a large number of inhumations and some cremations. Of the seven individuals whose skulls were complete enough to be measured, six had Gabrielino-like (Western Mono type) cranial indices (Patrick B. Stanton, personal communication 2008).

In 1924, some eight human skeletons were recovered in deeply buried contexts from the Haverty site (LAN-171; Figure 2), at the foot of the Baldwin Hills (Stock 1924). Three males, three females, and two subadults of indeterminate sex made up the population (Brooks et al. 1990). The dating of the skeletons is uncertain, but it appears that at least several of them (individuals 3, 4, and 5) may be in excess of 10,000 years old (Brooks et al. 1990:Table 1). Most interestingly, CI data are available on three of the individuals (3, 5, and 7), having CI values of 79.8, 77.9, and 78.1 respectively (Brooks et al. 1990:Table 2). These values are similar to the early populations on southern Channel Islands (e.g., Kerr 2004) and suggest a Californian type.

In 1936, a single isolated human skeleton, "Los Angeles Man" (LAN-172; Figure 2), was uncovered two miles west of the Haverty site in a stratigraphic

context similar to mammoth bones (Bowden and Lopatin 1936). The skeleton was initially believed to be Pleistocene in age (e.g., Heizer and Cook 1952:298; Bada and Helfman 1975:Table 7) but has since been radiocarbon dated to about 3,500 BP (Taylor et al. 1985; Brooks et al. 1990). Although the skull was damaged and could not be fully measured, Bowden and Lopatin (1936:508) believed it to be dolichocephalic (e.g., Western Mono type). It may be the earliest such example known in southern California.

In the western Mojave Desert/southern Sierra Nevada, archaeological cranial index data are few. While a number of cemeteries and isolated burials have been excavated, a variety of factors (including condition of skulls) have precluded assessment of CI values. Only one individual has a measured cranial index, an isolated burial (CA-KER-515; Robinson 1982) discovered near the city of Mojave (Figure 2) and dating to approximately 500 BP (Robinson 1982:42). This individual was a 50-year-old male with a cranial index of 73.8 (Robinson 1982:Table 1), a value well within the Western Mono type.

In sum, there is a considerable body of anthropometric and osteometric data suggesting that a population replacement on the southern Channel Islands occurred sometime around 3,300 BP, with the Western Mono type replacing the Californian type. This pattern is less clear on the mainland (where there are fewer data), and not all scholars agree that the existing data support a population replacement model (e.g., Gust 2005:D-68, D-69, Table K-1).

Group	Adult Men (cm)	Adult Women (cm)
Serrano	171 (n = 24)	158 (n = 1)
Luiseño	169 (n = 52)	157 (n = 42)
Cupeño	168 (n = 14)	156 (n = 20)
Cahuilla	167 (n = 28)	158 (n = 25)
Diegueño	–	164 (n = 1)
Mohave	171 (n = 45)	158 (n = 25)
Yuma	172 (n = 37)	161 (n = 5)
Cocopa	–	163 (n = 1)

Table 1. Summary of mean stature (cm) data on ethnographic southern California populations. The data in this table were taken from Gifford (1926:Tables 13 and 14).

Stature Data

Some information on the stature of ethnographic groups in southern California is available (Gifford 1926a:Tables 13 and 14) and is summarized in Table 1. While quite limited, the stature measurements do hint at a pattern. Each of the ethnographic Takic groups in the sample (Serrano, Luiseño, Cupeño, and Cahuilla) are similar to the surrounding Yuman groups, suggesting some biological linkage. Data on the Kitanemuk, Tataviam, and Gabrielino are, however, unavailable, making comparisons impossible.

The archaeological data on stature are equally scant. Rogers (1977) measured stature in three skeletal populations from southern California; one from Point Sal (Carter 1941; Moratto 1984:132-133) in the Santa Maria area (cf., Chumash), one from San Nicolas Island, and one from several sites in the San Diego area (e.g., La Jollan). Rogers (1977:3) reported that the skeletons in each of the samples dated between 8,000 and 7,000 BP. The average stature from the San Nicolas Island skeletal population was 160.2 cm for males and 152.6 cm for females, and the other two populations were of similar stature. All three of these populations were shorter than the surrounding interior ethnographic populations (Rogers 1977:Figure 6), the closest being to the north in the western Mojave Desert and San Joaquin Valley. Titus and Walker (2000:81) noted that the "inhabitants of San Clemente were about the same stature as the Indians who lived on the northern Channel Islands," and Kerr (2004:137) was unable to detect any change in femur length on the southern Channel Islands through time.

On the mainland, stature data are available from only a very limited number of sites but are generally similar

to the island samples. At the village of *Yaanga?* (CA-LAN-1575/H; Goldberg 1999), dated within the last 1,000 years, females averaged 149.6 cm. At the CA-LAN-2757 site near Compton (Figure 2), also dated within the last 1,000 years (Mirro et al. 2005:Table 5.1), one female burial had a stature of 150.9 cm. A larger sample was obtained from the nearby CA-LAN-2792 site (Figure 2; Mirro et al. 2005), dated to ca. 1,000 BP. At this site, four female individuals were measured, and all were taller than the other island or mainland samples (158.06, 152.21, 152.15, and 158.33 cm; Mirro et al. 2005:49-51).

A large sample of individuals was recovered from the a late burial population from the Peck Site (CA-LAN-62/H) and stature data was calculated on 32 females and 25 males (Patrick B. Stanton, personal communication 2008). The mean stature (based on femur length) was 158.74 mm for males and 147.64 mm for females.

No pattern has emerged from these data and the variation may be related to nutrition and/or health. It is possible that stature diminished from early to late populations as part of a general decline in health (e.g., Lambert 1993), rather than as a result of a population replacement. Based on data from San Clemente Island, however, Potter (1998:14) concluded that the earlier populations at the Eel Point site had poor general health relative to the later populations at the Nursery site.

Nonmetric Traits

In addition to the craniometric data, other differences were noted between early and late populations on San Clemente Island. Titus (1987:2) reported that the earlier (Californian type) individuals from the Eel Point site had "auditory exostoses and localized osteoarthritis . . . [suggesting] a maritime adaptation oriented toward diving and canoeing." The later (Western Mono type) individuals from the Nursery site lacked such evidence, suggesting that they were not diving for shellfish and that there may have been a substantial subsistence difference between the two groups (Titus 1987:21), a pattern also observed by Potter (1998:12-13). In contrast, Kerr and Hawley (2002:551-552; also see Hawley 2001:37) reported an increase of auditory exostoses in the late populations on San Nicolas Island, but suggested that the pattern could be explained by the colder water and a greater reliance on marine foods than that observed on the other Channel Islands. Most recently, Kerr (2004:135, Table 6.10) analyzed an expanded sample from all of the southern Channel Islands and reported no change in the percentage of auditory exostoses through time. This trait does not appear useful for distinguishing these populations.

On San Clemente Island, frequencies of traumatic injuries were measured in the Eel Point and Nursery site burial populations. The early population (from Eel Point) showed greater frequencies of traumatic injury than the later Nursery site population (Titus and Walker 2000:87), suggesting that violence was more prevalent before about 3,300 BP, a pattern also observed by Potter (1998:12). Kerr and Hawley (2002:548) suggested the possibility that the decrease in injuries after 1,500 BP might be related to the introduction of the bow and arrow, and a concomitant decline in the use of clubs.

Several other nonmetric skeletal traits for the southern Channel Island populations are of interest. Titus and Walker (2000:87) noted that earlier populations had fewer caries than later ones. Potter (1998:12) reported that dental health improved sightly from earlier to later populations on San Clemente Island. Kerr and Hawley (2002:551-552, Table 6) observed that when compared to early (pre-2,500 BP) samples, the late (post-2,500 BP) samples showed a drop (to zero) in tympanic dehiscence, a higher frequency of mandibular hypodontia, and a drop (to zero) in retention of the metopic suture. Kerr (2004:135-136) reported decreases in cribra orbitalia, linear enamel hypoplasias, and periosteal lesions from the early to

late periods. The data on these traits are concordant with the anthropometric data in supporting a population replacement (Kerr and Hawley 2002:552; Kerr 2004:139).

On the mainland, dental data were generated on a large burial population (N = 211) from CA-LAN-62/H, a late site located near Marina del Rey (Figure 2). That study (Babb 2009) revealed rates of caries that were higher and of enamel hypoplasias that were lower than on the southern Channel Islands. Although lacking comparative data from California populations, Babb (2009) compared the CA-LAN-62/H dental population to others in the Southwest and suggested that the "people of the Ballona Wetlands may have been most closely related to Uto-Aztecan speakers of the American Southwest."

DNA Data

One of the better biological lines of evidence to distinguishing populations and relatedness is DNA (e.g., Mulligan 2006). It is also useful in tracing population movements, including the movement of NUA populations (Kaestle and Smith 2001). The DNA data for southern California are quite limited and mostly derived from living populations (mtDNA), although some archaeological samples (aDNA) do exist.

The most comprehensive study of the molecular genetics of southern California Native Americans was conducted by Johnson and Lorenz (2006). Individuals of both the Serran and Cupan sub-branches of Takic provided samples, as did individuals from other linguistic groups, including Chumashan and Yuman. Johnson and Lorenz (2006:57) argued that the migration of Takic groups into southern California resulted in the "introduction of new genetic lineages into the area, as well as language replacement." The aDNA lineages among the Vanyume, Island Gabrielino, Desert Cahuilla, and Luiseño contained "hints of the surviving mtDNA lineages of the earlier inhabitants of southern California" (Johnson and Lorenz 2004:57). They further noted "the fact that these [surviving] lineages all persisted in relatively marginal areas [mostly interior areas] suggests that the dryer, desert regions served as the refugia for peoples who otherwise came to speak the language of a dominant incoming group who co-opted more favorable [the coast] habitats" (Johnson and Lorenz 2006:57). Eshleman et al. (2004:67) also reported some close genetic ties between Takic and Hokan populations, but suggested that it could be explained by gene flow.

The archaeological (aDNA) data base is currently quite limited. On San Clemente Island, Potter (2004) studied the aDNA of burial populations from the Eel Point and Nursery sites (the same sites where the cranial index data were obtained; see above). The Eel Point site dates to the Middle Holocene (perhaps as early as 4,500 BP; Potter 2004:50) and the Nursery site dates to the Late Holocene (after ca. 2,500 BP). In general, Potter (2004:100) found that the Eel Point and Nursery burial populations were genetically distinct from each other and that there was no close biological relationship (of either population) with Chumash, Penutian, or Washo, although there was some indication of admixture between the Eel Point burials and the Chumash (Potter 2004:92-95).

For the Eel Point population, Potter (2004:91, 96) reported that they were aligned with "extant California Uto-Aztecans" but were perhaps closer to Yumans. Further, the Eel Point population was not close biologically to Great Basin Uto-Aztecans (Potter 2004:97). According to Potter (2004:92), the Nursery population was biologically closer to Numic groups than to extant Californian Uto-Aztecans, that it was not close to Yumans (Potter 2004:97), and that there was a possible relationship with Northern Hokan groups (Potter 2004:94). She concluded that Uto-Aztecan peoples arrived in southern California during the Middle Holocene (Potter 2004:110; also see Kennett et al. 2007).

Genetic data have been obtained at several mainland sites. In the Santa Clara River Valley (ethnographic Tataviam territory), Eshleman (2003:80) reported that five burials at CA-LAN-2233 (Figure 2), dated between 2,400 and 800 BP, were probably genetically linked to NUA groups. In the Los Angeles area (ethnographic Gabrielino [Tongva] territory), several sites have contributed genetic data. A female individual from CA-LAN-2757 (Mirro et al. 2005), dated after ca. 1,000 BP, belonged to Haplogroup B, a trait suggestive of Takic affinities (Malhi and Eshleman 2005: C-3). Two female individuals from CA-LAN-2792 (Mirro et al. 2005), also dated after ca. 1,000 BP, were tested. One belonged to Haplogroup A, suggestive of admixture with Chumash (Malhi and Eshleman 2005: C-3), and the other belonged to Haplogroup B (Malhi and Eshleman 2005:C-3).

In a broad treatment of the genetics of prehistoric California populations, Eshleman and Smith (2007:296) noted that the Chumash and their northern neighbors (Salinan and Esselen) are genetically distinct from most other California populations, including Takic groups. More importantly, Eshleman and Smith (2007:296) observed that most California coastal populations had high frequencies of Haplogroup A, which is generally absent in interior groups. As noted by Eshleman and Smith (2007:296-297), however, "One notable exception to this coastal pattern is the mtDNA from [living] Takic speakers, in whom Haplogroup A is rare or nonexistent . . . [and the] rather abrupt discontinuity in mtDNA between Chumash- and Takic-speaking populations also speaks to an intrusion at some point in prehistory." The absence of Haplogroup A in Takic populations suggests an interior desert origin for the Takic groups.

Discussion

The DNA data for the prehistoric populations of southern California, particularly from archaeological samples on San Clemente Island, suggest the presence of a "Californian Uto-Aztecan" population in southern California by the Middle Holocene (e.g., Potter 2004:91; Kennett et al. 2007). Late Holocene populations on San Clemente Islands appear to be more closely related to Great Basin Uto-Aztecans than to extant Californian Uto-Aztecans (Potter 2004:97). This suggests the possibility that two groups of Uto-Aztecans had entered southern California at different times.

There is another possibility. The genetic data employed to characterize "Californian Uto-Aztecan" (e.g., Lorenz and Smith 1996) primarily derive from individuals speaking one of the Cupan languages, and the premise is that they are biologically "Takic." The majority of the samples (29 of 34; see Johnson and Lorenz 2006:Table 1) were obtained from living people belonging to one of the Cupan groups, with relatively few (5 of 34) being obtained from Serran groups and only two from the Gabrielino. If Cupan groups are biological Yumans who adopted Takic languages relatively late in time (as is hypothesized in this article), then most of the individuals used as baselines for Californian Uto-Aztecans may actually be biologically Yuman.

Indeed, Johnson and Lorenz (2006:45, 51) noted a "similarity in haplogroup distribution between Yuman and Uto-Aztecan groups" and "widespread phylogenetic relationships" between the Luiseño (who comprised 18 of the 34 Takic genetic samples; see Johnson and Lorenz 2006:Table 1) and Ipai (a Yuman group). This was attributed to extensive intermarriage between the two groups, but it could also be explained if the Luiseño were genetically Yuman people who adopted a Takic language. Potter (2004:96) also noted that the Eel Point population was "related" to Yumans but felt the "Californian Uto-Aztecan" link was stronger. The idea that Cupan Takic groups are biological Yumans is further supported by the observation (Eshleman and Smith 2007:297) that "modern southern California Uto-Aztecan groups appear more closely related to nearby Yuman speakers than to other Uto-Aztecan [SUA]

populations in the Southwest, Great Basin, or central Mexico." In addition, the Haplogroup C network mapped by Malhi et al. (2003:Figure 7) placed the one Luiseño sample and one of the Kumeyaay samples in the same location, with the Gabrielino (Tongva) in a separate location (and linked, most interestingly, to the Tubatulabal).

As noted above, Potter (2004:98) genetically linked the Late Holocene burial population from the Nursery site on San Clemente Island to Numic groups. If the Middle Holocene burial population was actually genetically Yuman, they would likely have been replaced by a Uto-Aztecan group from the north. This scenario is concordant with both the cranial index and linguistic data sets.

The Ethnographic Evidence

A variety of ethnographic data sets could be useful in exploring the movements of Takic people and/or languages. These include the ethnohistoric record, oral tradition, and general cultural patterns. A comprehensive examination of the ethnographic data is beyond the scope of this article, but there are some interesting hints relating to Takic movements and patterns.

Oral tradition often contains considerable and important information on a variety of subjects, although most of the specific data tend to reflect the recent past, within a century or so (Vansina 1985:197). Although the quantity and quality of data lessen dramatically prior to that time, some information remains useful. Regarding the Numic (a branch of NUA), oral tradition helped to illuminate the Numic expansion (ca. 1,000 BP; Sutton 1987, 1993a) and Numic ethnobiology (Sutton 1989a). Laylander (2006) argued that Californian oral tradition data had no application to times before about 1,000 BP, implying that the hypothesized initial entry of the Takic into southern California (ca. 3,500 BP) occurred too early to be reflected in Takic oral tradition. If Cupan languages diffused into Yuman groups after about 1,000 BP, however, information in oral tradition may be applicable to that issue.

A direct reference to the migration of the Juaneño (Luiseño) appeared in Boscana (1978:83, 85), who noted that the founders of *Putuidem* (CA-ORA-855; Figure 2) had come from the north, speaking a language close to Gabrielino and that they changed their language. Following this line of thought, Koerper et al. (2002:68) suggested that "some Gabrielino peoples migrated from places somewhere between southern Los Angeles County and the Santa Ana River to the San Juan Capistrano Valley area." Other migration stories include one in which the Desert Cahuilla moved east into the Coachella Valley (Strong 1929:86-87, 100-102) (Figure 2). Another told of the Morongo clan of the Serrano coming from the "far north" (Gifford 1918:183), and there is a Cupeño story about a group of Cahuilla that moved south, intermarried with the Luiseño, and became the Cupeño (Gifford 1918:199-201; Strong 1929:270-273).

There are several cultural patterns that appear to differentiate Serran and Cupan groups. The first is that of social organization, specifically moieties. Among the Serran groups, it was reported that the Kitanemuk did not have moieties (Blackburn and Bean 1978:567), that the Serrano did have moieties (Gifford 1918:177, 178; Strong 1927:10, 1929:22; although Benedict [1924:371] disagreed), and that there were too few data on the Tataviam to determine the presence or absence of moieties (King and Blackburn 1978). Among the Cupan groups, the Gabrielino might have had moieties (Strong 1927:9; Bean and Smith 1978a:543). It was reported that the Luiseño lacked moieties (Gifford 1918:177, 1926:392; Kroeber 1925:685; Strong 1927:9; Bean and Shipek 1978:555), but they were present among the Cahuilla (Gifford 1918:177, 186; Strong 1927:10, 1929:70, 109, 169; Bean 1978:580) and Cupeño (Gifford 1918:177, 192; Strong 1927:10; Bean and Smith 1978c:588; but see Strong 1929:234). Bright

and Hill (1967:351) thought that Cupeño moieties were derived from those of the Cahuilla, suggesting a common origin, as was hypothesized for the Cupeño and Cahuilla languages (Bright and Hill 1967:362).

Interestingly, the Cahuilla, Cupeño, and Serrano all had clans and moieties, while the Luiseño and the neighboring Yuman groups had clans but no moieties (Gifford 1918:167, 215, 217). There is little evidence of clans for the Kitanemuk, Tataviam, or Gabrielino. This reveals a general pattern in which most Cupan groups had moieties while most Serran groups did not. The paucity of ethnographic information regarding social organization among the Serran groups diminishes the clarity of this pattern. Nevertheless, Strong (1927:47) believed that the mixed pattern of moieties in southern California was partly the result of "intrusions from the north and east of non-dichotomous groups." This follows the suggestion herein that the "non-dichotomous" Kitanemuk may have been the original Serran Takic group.

What little is known of the Kitanemuk suggests that they were linked with other Takic groups to the south rather than the Cupan groups to the east. Kroeber (1925:613) had little to say about Kitanemuk sociopolitical organization, but did note that they buried their dead, drank jimsonweed, and appeared to be at war with the Tataviam at the time of contact (an unusual situation within NUA groups; see Sutton [1986]). Kroeber (1925:613) noted that the Yokuts prayed to some southern California deities linked to the Gabrielino through the Kitanemuk. Further, Blackburn and Bean (1978:568) argued that Kitanemuk mythology was related to the neighboring Yokuts, Chumash, and Gabrielino.

Takic groups suggested herein to have originally been Yuman also appear to have shared an internal pattern of culture. Strong (1927:21, 33-37, 56, 1929:337-339) noted that the Luiseño, Cupeño, Serrano, and Cahuilla all shared a common cultural pattern, including aspects of social organization, creation stories, many ceremonies, mourning rites, and eagle killings. Interestingly, the southern Takic themselves recognized western (Gabrielino?) and eastern (Cupan?) divisions (Dubois 1908:148-150).

This same basic pattern was recognized by Klimek (1935), who studied cultural traits and groupings of tribes across California. He noted (1935:34) that the group representing the southern California province "includes Diegueño, three Cahuilla tribes, Cupeño, Luiseño, Serrano, and Gabrielino. The center of this group, consisting of very high coefficients, contains only Cahuilla, Cupeño, Luiseño, and Serrano. On one wing of the center we find Diegueño, on the other Gabrielino." No data for the other Takic groups was available for that study, but it was clear to Klimek (1935) that Gabrielino was separate, though related, to the Cupan groups, who were linked to the Yuman Diegueño. This is exactly the pattern of relationship to be expected if Gabrielino diffused into Yuman groups.

To summarize, this body of evidence, albeit only suggestive, does support the idea of a cultural differentiation between Serran and Cupan groups. Differences such as these might be expected if the Serran and Cupan groups had evolved through separate trajectories and processes.

The Archaeological Evidence

The archaeological record should reflect a new population moving into an area and replacing an existing one. Identification of linguistic and/or ethnic groups in the archaeological record occurs with difficulty and depends on the identification of marker traits and their spatio-temporal distributions. Given that Takic groups occupied much of southern California at contact, the direct historical approach could be useful, at least with some aspects of the archaeological record (but see Wobst 1978). The direct historical approach has been employed implicitly by most investigators who have

adopted the term "Shoshonean" to describe the Takic arrival into southern California.

Basic to this approach is the premise that populations possess unique cultural assemblages, that they carry those assemblages as they migrate, and that such assemblages can be tracked in the archaeological record (Rouse 1986:3-13). It is assumed that prehistoric groups (archaeological cultures) can be recognized through the identification of their unique constellation of traits, such as those of technology, mortuary practices, and settlement and subsistence patterns. Combinations of traits, or sometimes single traits (e.g., cremations), are commonly used to define archaeological cultures. Thus, it is necessary to identify "Takic" marker traits and trace those traits back to their first appearance.

Considerations of "Takic" Markers

What are the archaeological markers of the Takic? It has been suggested that some aspects of technology, such as projectile points, textiles, and ceramics, could be Takic markers. Mortuary practices and settlement and subsistence patterns have served as indicators of a Takic intrusion. These lines of evidence are considered below.

Projectile Points

Kroeber (1925:578-579) proposed that the Takic entered southern California about 1,500 years ago, a date that generally matches the arrival of bow and arrow technology from the north. This conjunction has suggested to some (e.g., Koerper et al. 1994) that the arrival of bow and arrow technology marked the arrival of the Takic ca. 1,500 BP. Further, Koerper et al. (2002:63-64) suggested that the initial appearance of Cottonwood points in Orange County coincided with the "arrival of Takic migrants from the Great Basin."

Small projectile points, generally weighing less than 3.5 grams, are generally classified as arrow points (following Fenenga 1953) and reflect the use of the bow and arrow. It seems unlikely that the atlatl was abruptly replaced, and atlatls probably coexisted with the bow and arrow for some time (Yohe 1998:49). The bow and arrow diffused into the Mojave Desert from the north about 1,500 BP (Yohe 1998:28), an event heralded by the appearance of Rose Spring series points. Rose Spring series points are the only recognized arrow points in the Mojave Desert until they are replaced by Desert series points ca. 1,000 BP (Sutton et al. 2007:241).

It is generally believed that the bow and arrow entered coastal southern California about 1,600 BP (Koerper et al. 1996:276). This may be a bit too early, as this technology did not enter the northern Mojave Desert until about that same time, and it would have taken some time to move further south. Thus, the introduction of the bow and arrow into coastal southern California was probably somewhat later, perhaps about 1,500 BP.

As in the Mojave Desert, Rose Spring series projectile points should have accompanied the bow and arrow into coastal southern California. Rose Spring points (Heizer and Baumhoff 1961:123) consist of three varieties of small arrow points, corner-notched, side-notched, and contracting stem (Heizer and Hester 1978:7-10). These points generally date between 1,500 and 900 B.P. in the Mojave Desert (cf., Bettinger and Taylor 1974:19; Heizer and Hester 1978:9; Yohe and Sutton 2000). Thus, one would expect Rose Spring points to be the first arrow point type in southern California, but surprisingly few have been identified there (Koerper et al. 1996:261; Robinson 1998:36). Koerper et al. (1996:261) suggested that the earliest arrow points in southern California might simply be smaller versions of the atlatl points in use prior to the introduction of the bow and arrow. It is also possible that the bow and arrow entered southern California later in time.

While Rose Spring points are rare, an equivalent point series, Marymount, was identified in the Los Angeles

Basin by Van Horn (1990:29, 32-33; Van Horn and Murray 1985; also see Koerper et al. 1996:261) and appears to be the coastal equivalent of the Rose Spring series. The Marymount point series was defined as arrow points that are "distinctive by form and [local] material" (Van Horn 1990:29). Marymount points are small (less than 40 mm.), light (generally under 3.5 g.), shouldered or tanged, and usually made of fused shale (local to southern California). Van Horn (1990:33) dated Marymount points between ca. 1,600 and 900 BP. All of the Marymount points illustrated by Van Horn (1990:Figs. 1 and 2) would have been classified as Rose Spring had they been found in the Mojave Desert, and their dating mirrors that of the Rose Spring series. Van Horn (1990:33, 35) suggested that "Marymount points should probably be regarded as a regional variant of a more widespread arrowhead type," in essence the southern California coastal variant of Rose Spring. It appears likely that the appearance of Marymount points (or of Rose Spring points) in coastal southern California represents the introduction of the bow and arrow into the region about 1,500 years ago.

In coastal southern California, Cottonwood points appear about 1,000 BP (e.g., Koerper et al. 1996:269) and mark the beginning of the Late Period (ca. 1,000 to 150 BP). They presumably diffused into the region from the Mojave Desert to the north. The Cottonwood type was first defined by Lanning (1963:252-253; also see Riddell 1951:17; Riddell and Riddell 1956:30), who identified two major subtypes, triangular and leaf-shaped. Lanning (1963:275) observed that the two Cottonwood types from the northwestern Mojave Desert were "both nearly identical to common south coast types, though the coastal specimens are of chert rather than obsidian." In order to distinguish coastal from desert contexts for these points, it was proposed that the label "Coastal Cottonwood series" be used for coastal specimens (Marshall 1979:24; also see Koerper and Drover 1983:16; Koerper et al. 1996:269). Cottonwood points are found in large numbers from late contexts in southern California (Koerper and Drover 1983; Koerper et al. 1996; Rosenthal and Hintzman 2003).

In southern California south and east of the Chumash, Cottonwood points appear to be generally confined to Takic territory and have been used to differentiate Takic groups from Numic groups to the north (Sutton 1989b) and Yuman groups to the south (True 1966:280; also see Pigniolo 2004), both of whom used small side-notched points (e.g., Desert Side-notched). Even if they are not markers of a Takic entry into southern California, Cottonwood points may be markers of a Takic move east after about 1,000 BP.

If the arrival of the Takic into southern California was prior to the arrival of the bow and arrow, atlatl points (such as those of the Elko and/or Gypsum series) would be the Takic markers. A variety of contracting stem points is known from coastal southern California, and they have often been classified within the Gypsum series (following Heizer and Hester 1978:13; but see Thomas 1981:35) as Elko contracting stem, or as Vandenberg contracting stem (see Justice 2002:241-275). The Gypsum and Elko series generally date between 4,000 and 1,800 BP in the Mojave Desert (Sutton et al. 2007:241). Other contracting stem forms (e.g., Vandenberg) generally date to the same time. Along the coast, large contracting stem points are considered by some (e.g., Harrison 1964; Moratto 1984:137-138) as markers of the Hunting Culture or Campbell Tradition. Thus, such points would date to the early Intermediate Period (also see Koerper and Drover 1983:14).

Certain uncommon contracting stem points (often called Gypsum) have been identified in southern California (Koerper et al. 1994:Table 3; Macko 1998:103). Elko series points (Heizer and Baumhoff 1961; also see Heizer and Hester 1978:5-7; Thomas 1981:32-33) date between about 4,000 and 1,500 BP. (cf. Bettinger and Taylor 1974; Heizer and Hester 1978) and are commonly recovered from southern California sites

(Koerper and Drover 1983:10, 12; Lambert 1983: Figure 3; Koerper et al. 1994:Table 3; Cleland et al. 2007:191, 193), although rarely in large numbers (but see McDonald et al. 1987).

The use of projectile points of any kind as markers of the initial Takic entry into southern California appears problematic. If the Takic entered southern California late in time and brought the bow and arrow with them, then Marymount (Rose Spring) points, not Cottonwood forms, would be the marker. If the Takic arrived earlier, they would have been using atlatl dart points, such as Elko series points. Interestingly, however, if Takic languages diffused east to Yuman groups after about 1,000 BP, then Cottonwood points could be a marker for that event. Indeed, Wilke (1974:22; also see Robinson 1998) noted the virtual absence of projectile points in the sites around the Perris Reservoir prior to ca. 900 BP, after which only Cottonwood forms were found. Wilke (1974:22) did not equate this to the introduction of the bow and arrow, but suggested that hardwood tips (which would not preserve well) were used on arrows prior to the arrival of Cottonwood points.

Textiles

Textiles (e.g., basketry) can be a sensitive artifact class in the delineation of ethnic units (Adovasio 1986:45) due to the presence of discrete and easily measurable traits (e.g., specifics of construction, decoration). Such traits are typically regarded as "artistic" rather than functional and are therefore more likely to be viewed as specific to certain groups (as function often cross-cuts cultural boundaries). Some data on ethnographic and prehistoric basketry specimens are available from southern California.

Kroeber (1925:613) noted that ethnographic Kitanemuk basketry resembled the San Joaquin (Yokuts) type rather than the southern California type. He further reported that the Gabrielino used the "Mission basketry" common throughout southern California (Kroeber 1925:628). In addition, Luiseño and Cahuilla basketry was seen as virtually identical (Benedict 1924:386; Kroeber 1925:653).

The archaeological data are a bit more useful. Rozaire (1967:330; also see Rozaire 1957:90, 1959a, 1959b) noted that late archaeological basketry on San Nicolas and San Clemente islands (see Figure 2) was S-twist while the materials on the northern islands were Z-twist (with the apparent premise that S-twist replaced Z-twist at some point in time). Rozaire (1967:330) dated some of the S-twist materials from San Nicolas Island to 2,550 BP and suggested that this might date the Takic entry into the region. Lauter (1982:87-88) indicated that S-twist appeared as early as ca. 3,700 BP, suggesting that the Takic entry dated to prior to that time. In addition, the burials from the late Nursery site on San Clemente Island had associated S-twist materials (Titus 1987:23). Lastly, a coiled basketry impression from CA-SNI-11 on San Nicolas Island was dated to about 4,000 BP and represented the earliest known coiled basketry in the region (Bleitz 1991). While vague, there is a hint of some change in basketry between about 4,000 and 2,500 BP.

Ceramics

At the time of contact, most groups in southern California used pottery, generally Tizon Brown Ware, although lower Colorado Buff wares were also used by the Cahuilla. The Gabrielino did not use pottery until later (Kroeber 1925:628). Koerper et al. (1978) noted the presence of brown ware pottery at a few sites in Gabrielino territory and suggested that some was made locally but that some was traded in, either from the Serrano, Cahuilla, or Luiseño. Sparkman (1908:201) reported that the Luiseño had pottery before contact, but this pottery appears to have arrived within the last 400 years, as part of the San Luis Rey II Complex (True et al. 1991:8-11).

Pottery is a late trait in southern California. Tizon Brown Ware dates after about 1,300 BP and occurs widely throughout southern California, southern Nevada, and western Arizona (e.g., Lyneis 1988). Lower Colorado Buff wares were made after about 1,100 BP (Waters 1982a, 1982b). As a result, pottery is not a "marker" for the initial entry of the Takic into southern California. It almost certainly diffused into southern California from the south and east late in time.

Other Material Traits

It has been suggested (Howard and Raab 1993; Vellanoweth 1995; Raab and Howard 2002; Kennett et al. 2007) that *Olivella* Grooved Rectangle (OGR) beads are NUA (Takic) markers. These beads date to around 5,000 BP, and are one of the primary artifacts of the Western Nexus (Sutton and Koerper 2009), a proposed Middle Holocene interaction sphere linking coastal southern California with the northwestern Great Basin. The dating of the Western Nexus (ca. 5,100 to 4,500 BP) is too early for NUA groups to have been in the northwestern Great Basin (see Sutton and Koerper 2009; Madsen and Rhode 1994), so OGR beads cannot be markers of northern NUA territory at that early date. It is argued herein that NUA (Takic) groups did not enter southern California until about 3,500 BP, again too late to be involved in the Western Nexus.

It is possible that single-piece circular *Haliotis* fishhooks may relate to the arrival of Takic groups. They appear to date after ca. 3,300 BP (Koerper et al. 1988, 1995, 2002:68; Raab et al. 1995:14) or perhaps as late as about 2,500 BP (Rick et al. 2002) and may mark an intensification of fishing, as was reported by Raab et al. (1995:14) on San Clemente Island after about 3,300 BP. It may appear odd that the Takic, presumably an interior, terrestrial-focused group, would bring fishhooks to the coast. It is not suggested here that Takic groups carried fishhooks to the coast, only that it is possible that they invented them once they reached the coast and took up fishing. If the Takic people had been in the southern San Joaquin Valley prior to the move south, they would have already been familiar with fishing. In addition, Kowta (1969:48) suggested that bone harpoon points might also be an indicator of the Takic.

Lastly, stone beads of Sierra Pelona schist have been suggested as Takic markers (e.g., Altschul et al. 2007:35; also see King 1990:133), and such artifacts have been found in the western Mojave Desert (Sutton 1988:44) and southern California.

Dog burials may also have some link to Takic traditions. Such burials are well known in the Central Valley (e.g., Gifford and Schenck 1926; Heizer and Hewes 1940) and from Takic territory in southern California (e.g., Langenwalter 1986, 2005). In the Central Valley, the earliest dog burials date to about 4,000 BP (Haag and Heizer 1953:263), but in mainland southern California the known dog burials all date within the last 1,000 years (Langenwalter 1986:Table 3). On the Channel Islands, however, dogs appear to have been present through much of the Holocene (Rick et al. 2008), but for San Nicolas Island, Martz (unpublished, cited in Kerr and Hawley [2002:549]) thought that dog burials were mostly confined to Late Period sites. This suggests the possibility that the practice of dog burial is a Takic trait, perhaps practiced first in a part of the Takic homeland in the Central Valley and taken south as the Takic migrated.

Mortuary Practices

Cremation is widely considered to be a Takic "marker" (e.g., King and Blackburn 1978:535) and is often seen as evidence of population movement from the deserts, where it is assumed people cremated their dead. King (1990:199; also see Gamble and Russell 2002:123) suggested that cremation appeared in southern California ca. 3,500 BP and thought it was related to the arrival of Takic groups. To the contrary, there appears to be little to support this belief. The

idea that the Takic cremated may have originated from researchers reading reports, such as from Wallace (1962:177), who described cremations in the deserts (many containing glass beads) as a "Shoshonean" trait. The Shoshoneans to whom Wallace referred, however, were not Takic but Numic, and the indiscriminate use of the term "Shoshonean" to describe NUA groups across most of western North America continues to be confusing. In fact, Lowie (1923:149) reported that in southern California, the only groups who cremated were "those which in recent times adopted the South Californian mourning ceremony," suggesting that cremation was late and not widespread.

An examination of the ethnographic record on mortuary patterns for Takic groups is most useful. Among the Serran branch, the Kitanemuk interred their dead (Kroeber 1925:613; Harrington 1942:37; Blackburn and Bean 1978:566), and this pattern appears to have been in place for at least the last 2,500 years (Sutton 1980, 1988). The mortuary pattern for the Tataviam is unknown (King and Blackburn 1978), but archaeologically, Tataviam mortuary practices appear to have consisted of interment (Sutton 1980, 1988; Robinson 1987; Waugh 2003). The Serrano were reported to have cremated their dead (Drucker 1937:36; Bean and Smith 1978b:572), but both Benedict (1924:382, 389) and Strong (1929:32) described the Serrano as having practiced interment.

The Gabrielino practiced some cremation on the mainland (Kroeber 1925:633, 641; also see Gould 1963) but apparently not on the southern Channel Islands, so that "an ancient difference of custom separated the islanders from the bulk of the Gabrielino on this point" (Kroeber 1925:633). This suggests that in the past the Gabrielino practiced inhumation with cremation later being adopted on the mainland but not on the islands. This idea was supported by Bean and Smith (1978a:545), who also reported cremation on the mainland but not on the islands. Early archaeologists (e.g., Alliot 1916) did not report cremations on San Nicolas Island, but subsequent work has demonstrated the presence of at least some cremations on the southern islands (Woodward 1941:285; Meighan and Eberhart 1953:111; Sayler 1959:168, 173; also see McKusick and Warren 1959:136; Rozaire 1967:331, 1970:142-144). Gould (1963:155) suggested that the Gabrielino practiced primary inhumation but cremated people who died away from home to make it easier to transport their remains back home. A large ethnohistoric Gabrielino burial ground near Marina del Rey (CA-LAN-62/H) contained mostly interments.

Among the Cupan, cremation was widely reported, including for the Luiseño (Sparkman 1908:226; Kroeber 1925:675; Strong 1929:299; Drucker 1937:36), Juaneño (Kroeber 1925:641), and Cupeño (Drucker 1937:36; Bean and Smith 1978c:589). Strong (1929:264) noted that the Cupeño cremated "in the past." The Cahuilla also cremated "in the past" (Strong 1929:84; also see Hooper 1920:343-344; Strong 1929:84, 121, 141; Drucker 1937:36). Strong (1929:80) further noted,"As occurred among all these [Cahuilla] groups in early times, the bodies of the dead were burned according to native tradition; but within the memory of all informants the body of the deceased was buried soon after death."

The ethnographic record indicates that both inhumation and cremation were practiced by Takic groups. Groups of the Serran branch appear to have mostly interred their dead, although cremation was sometimes practiced. Cupan groups appear to have primarily cremated, but there are indications of occasional inhumation. These two patterns differentiate the Serran and Cupan, as seen in some other cultural features (see above).

The apparent homeland of the Takic is the western Mojave Desert and perhaps the southern Sierra Nevada and southern San Joaquin Valley, and if cremation was a Takic trait, it should have been practiced in these regions prior a the Takic movement. To the

contrary, however, there is little archaeological evidence that Takic groups in the western Mojave Desert practiced cremation. While a few undated cremations are known (Sutton 1980, 1988:Table 5), a number of relatively large cemeteries containing inhumations (mostly flexed) are known in the region (Toney 1968; Sutton 1980, 1988; Robinson 1987; Waugh 2003).

In the central and eastern Mojave Desert (which was not Takic territory), few detailed mortuary data are available. In the Death Valley area, both cremations and inhumations dating from the Protohistoric Period (Death Valley IV) have been found (Hunt 1960:115-116, 191-192), often with glass beads (Wallace 1977:133). Inhumations and cremations (all undated) are known along the Mojave River (e.g., Smith 1963:87). Cremations and inhumations are also known from the Cronese Lakes area (Drover 1979:175-176). A few cremations with Southwestern ceramics dating to about 600 BP have been found in the Mojave Sink area in the central Mojave Desert (Rogers 1945:176), and Hillebrand (1972) reported cremations for the Chapman Phase (Rose Spring Complex) in the northwestern Mojave Desert. Campbell (1932) reported some cremations in the Twentynine Palms area, but they also appear to be late. In the Cajon Pass, inhumations were reported at the ethnohistoric Serrano village of Muscupiabit (CA-SBR-425/H; Grenda 1988; Gardner and Sutton 2008), but this is unconfirmed and undated. In most of the Mojave Desert, mortuary data are too few to attempt any reconstructions of the methods for the disposal of the dead or artifact associations with the deceased.

In the southern San Joaquin Valley, where it is possible that Takic groups resided as late as about 3,500 BP, cremation was present but uncommon (e.g., Moratto 1984:181-183). More recently, Rosenthal et al. (2007:154-155) recognized a "tradition of extended burial posture" throughout the San Joaquin Valley during the Middle and Late Archaic. This does not support the idea of a tradition of Takic cremation originating in this region.

Of further interest is the record of prehistoric mortuary patterns in southern California, where it is commonly assumed that cremation was the prevalent practice among the Takic. Cremation is actually uncommon in the archaeological record of the region, which instead exhibits a long record of extended and flexed inhumation. Meighan (1954:225) thought that cremations in southern California reflected Southwestern influences. Rozaire (1967:331) argued that inhumation was the primary method in the coastal and interior regions of southern California, but that cremation became increasingly important and eventually replaced inhumation in late historic times. Orr (1968:197) reported that the "Shoshonean" practice was "burying their dead in the floor of the dwelling" and did not mention cremation.

Some archaeological mortuary data are available from Tataviam territory. The pattern is one of inhumation (Sutton 1980, 1988; Robinson 1987; Waugh 2003), with occasional cremation (e.g., at CA-LAN-2233; Waugh 2003). King (1981:326-327, 1990:199) reported the presence of "cremation cemeteries" in Tataviam territory, but the nature and age of these sites are unclear.

Allen (1994) conducted a comprehensive study of 382 burials from 50 sites in southern California Takic territory. She found that while cremation was practiced occasionally, inhumation was the primary mortuary method and that this pattern was at least several thousand years old (Allen 1994), a pattern similar to that of the western Mojave Desert (see above). Primary interments dominated the coastal samples while cremations were more common in the "interior" (more than 10 miles from the coast; Allen [1994:141]). Allen (1994:128, 137, 139, Figure 6) noted several changes in mortuary practices after about 1,500 BP, including an increase in cremation to about 20 percent, an absence of basketry impressions, an absence of extended burials, and the appearance of obsidian grave goods.

Allen (1994:155) believed that most of the ethnographic data describing Takic groups as practicing cremation were derived from "interior" Takic groups. Cremation may have significant time depth in southern California, and Allen (1994:156, 159) believed that it was "more plausible that the practice of exclusive cremation was a Yuman trait that was adopted by certain Shoshonean groups" late in time and that cremation may have been a cultural holdover as Yumans adopted Takic languages late in time. As to the timing of a Takic entry into southern California, Allen (1994:159) suggested that the continuity of burial patterns in the late period argued for an "earlier, rather than a later" date.

Koerper and Fouste (1977:40-44) examined the archaeological record of the Gabrielino area and concluded that cremation was relatively rare. They suggested that an "older pattern of burial was superseded by a pattern of cremation in some but not all areas of Gabrielino territory" (Koerper and Fouste 1977:41). Data from the late period village of *Yaanga?* (CA-LAN-1575/H) along the Los Angeles River near downtown Los Angeles led Goldberg (1999:122) to conclude that inhumation was the dominant mortuary method until replaced by cremation very late in time.

The mortuary patterns within Gabrielino territory were examined by Gamble and Russell (2002). They considered data from 13 sites and found both inhumations and cremations at each (Gamble and Russell 2002: Table 7.1). The earliest evidence of cremation was at the Encino Village site, or CA-LAN-43 (Cerreto 1986) (see Figure 2), where a cremation mortuary was dated to the early Middle Period (ca. 2,600 BP) (King 1990:111). Gamble and Russell (2002:123) concluded that mortuary patterns "changed at the beginning of the Late Holocene [ca. 3,500 BP] and that this change might be the result of the influx of Takic speakers into the Tongva region."

Wheeler (2004) also studied Late Period Gabrielino mortuary patterns. He noted that many sites in Gabrielino territory with cremations were located near the border with the Chumash and suggested that cremations represented people who controlled particular resources (Wheeler 2004:56-57, 59). Moreover, Wheeler (2004:132) reported that "cremation almost completely replaced inhumation as a mortuary treatment [among the Gabrielino] during the latter half of the Late Period," that is, after about 700 BP. He further suggested that this shift toward cremation as a "special" mortuary treatment might be related to climatic conditions (e.g., the Medieval Climatic Anomaly) (see Stine 1994) as a method by elites to exert property or resource rights in a time of increasing stress (Wheeler 2004:133). It may well be, however, that cremation was employed when people died away from home (following Gould 1963:155). Finally, many Gabrielino inhumations contained grave goods (e.g., at CA-LAN-62/H; see below) while cremations did not, suggesting the possibility that cremation was a treatment for the "poor."

Most recently, a large Late/Ethnohistoric Period burial ground (CA-LAN-62/H; Altschul et al. 1992; Koerper et al. 2008; see Figure 2) was investigated near Marina del Rey. The vast majority of the individuals discovered were primary inhumations, reinforcing the fact that cremation was not an exclusive (or even common) practice, even late in time. The relatively few cremations included individuals of both sexes and various age ranges.

Hudson (1969:17) examined the record of Orange County and concluded that while cremations were present at a few sites, "the majority of [sites] . . . have provided a consistent pattern of flexed burials and no cremations," further noting that cremations constituted "only four percent of the total number of graves." Cremations from Orange County, he believed, were in stone vessels, a trait ostensibly linking them to the very late San Luis Rey II Complex (e.g., Meighan 1954; True et al. 1991). Hudson (1969:21-22) reported that cremations were present inland but were

rare on the coast and speculated that the practices of inhumation and cremation "were contemporaneous among Shoshonean [Takic] inhabitants of Orange County," citing "a flexed burial complex in the coastal and prairie provinces, and a cremation complex in the intermediate mountain and foothill province" (Hudson 1969:22). He further speculated that cremation diffused in from the south (Hudson 1969:22). Citing Harrington (1955:27), Hudson (1969:57) also suggested that the ethnographic method of preparing a body for cremation (wrapping it in a flexed position) evolved from the former practice of burying a body wrapped in a flexed position.

As noted above, the earliest evidence for cremation in coastal southern California is from the Encino Village site (CA-LAN-43), dated about 2,600 BP, perhaps a millennium later than the ca. 3,500 BP date postulated herein as the arrival date of the Takic in the region from their homeland to the north. The fact that cremation was not generally practiced in those northern homelands suggests that cremation was not brought south with the Takic, but adopted once they were in southern California. Large mortuary features (see below) containing cremated human bones appear about the same time as the earliest cremations, suggesting a link between the two practices.

In sum, it is problematic to view cremation as a marker of the Takic entry into southern California. Cremation is generally rare in the Takic homeland and is uncommon within the Serran branch of Takic. The appearance of cremation and large mortuary features about 2,500 BP suggests that the Takic adopted a new mortuary custom for some segment of the population but that inhumation remained the prevalent practice through time. Cremation is more common in areas occupied by Cupan groups and may be a Yuman trait that diffused in, or it was possibly retained by those groups after they adopted Takic languages after ca. 1,000 BP. In addition, inhumations in the western Mojave Desert are generally flexed (matching most of the record in southern California), while most inhumations in the southern San Joaquin Valley are extended (Rosenthal et al. 2007:154-155).

Not all of the cremations known in southern California are primary, suggesting that cremated remains may have been moved, perhaps the remains of those who had died elsewhere (e.g., Gould 1963:155). It is also possible that inhumations were subsequently exhumed and the bones cremated. Secondary inhumations have considerable time depth in coastal southern California (Walker 1937; Treganza and Malamud 1950; Treganza and Bierman 1958; Littlewood 1960; Rozaire 1960; Johnson 1966; King 1967), and it may have been a simple step to burn the bones rather than reinter them.

It remains possible, however, that cremations are simply under represented in the data base. Cremated bones are usually highly fragmented and difficult to identify, complicating efforts to detect cremations (e.g., Koerper and Gundlach 2006:158). Even so, the presence of large numbers of inhumations in Serran territory fundamentally invalidates the use of cremation alone as a Takic marker trait.

Mourning Features

Although cremation appears to have been a relatively uncommon practice in southern California (see above), large thermal features containing cremated remains are known from a few sites in southern California and have been interpreted as mourning complexes. No such features are known from the western Mojave Desert, and the earliest one identified in southern California is about 2,200 years old. Such features have been documented at several sites near Oxnard, in Chumash territory. These include CA-VEN-24/26 (Martz et al. 1995) (see Figure 2), dated between about 1,600 BP and 650 BP, and Calleguas Creek (CA-VEN-110; Greenwood et al. 1986; Raab 1994; Martz et al. 1995) (see Figure 2), dated between 1,100 BP and 700 BP.

Along the Los Angeles coast, large mourning features have been found at two sites. The first, the Del Rey site (CA-LAN-63; Van Horn 1987; Altschul et al. 2005, 2007; Hull et al. 2006) (see Figure 2) near Marina del Rey, contained one such feature with cremated human bones (plus two others without human bone) and numerous artifacts dated to about 2,200 BP (Hull et al. 2006; also see Altschul et al. 2007). The second is at the Landing Hill (also known as Hellman Ranch) site complex, or CA-ORA-263 (Cleland et al. 2007) (see Figure 2) in Seal Beach. This feature contained many ground stone artifacts and more than 10,000 fragments of cremated human bone. It was dated between ca. 2,200 and 1,600 BP, suggesting reuse over time.

In addition, two sites in the San Fernando Valley contained cremated human bone in association with concentrations of broken milling equipment. These sites, Chatsworth (CA-LAN-21; Walker 1939, 1951; Tartaglia 1980) (see Figure 2) and Big Tujunga Wash Village (CA-LAN-167; Walker 1951) (see Figure 2), are poorly dated.

Settlement Patterns

A new population that entered a region from a different area would likely retain, at least initially, aspects of their settlement system, which would be manifested in the archaeological record as new intra-site and inter-site organizations. Unfortunately, understanding such changes is difficult due to the quantity and quality of currently known settlement data.

The archaeological record of settlement patterns in the western Mojave Desert, a portion of the putative Takic homeland, is poorly understood. The current view (see Sutton 1996:243-244) is that the western Mojave Desert was sparsely occupied between about 4,000 and 2,500 BP. A major change in settlement systems in the western Mojave Desert, with an increase in the number and size of sites and the appearance of large villages, was reported by Sutton (1980:223, 1988:86; also see Warren 1984:423-424; Gardner 2007). These large villages contained structures, cemeteries, and substantial artifact assemblages, including large numbers of shell beads. Some 45,000 *Olivella* beads were recovered from CA-KER-303 (see Figure 2) alone and 5,000 from one burial at CA-LAN-488 (Sutton 1988:48-49) (see Figure 2). In addition, considerable numbers of steatite artifacts are present in these assemblages (Sutton 1988:44). Sutton (1980, 1988) originally dated this settlement shift to about 3,000 BP based on an estimate of the establishment of CA-KER-303, one of the major villages. Given that the earliest date from CA-KER-303 is about 2,400 BP (Sutton 1988:Table 1), the timing of the establishment of large villages should be revised back to about 2,500 BP. This seems too late to have been the prototype of a Takic settlement pattern in coastal southern California.

The settlement pattern in the San Joaquin Valley around 3,500 BP is even more poorly understood. Villages were associated with lakes and sloughs (see Hartzell 1992; Rosenthal et al. 2007), and smaller sites were associated with other ecozones. Too few data are available from the valley to link with any Takic pattern.

Few areas in coastal southern California contain enough data to model settlement patterns through time (but see Hudson 1971). One area that does is the Ballona wetlands in Marina del Rey, where many sites dating from Millingstone to historic times have been investigated. During Millingstone times, until about 3,000 BP, the tops of the bluffs along the Ballona were well-occupied while the bases of the bluffs, where the marshes were located, were only sparsely occupied (Altschul et al. 2005; Douglass et al. 2005; Van Galder et al. 2007). Interestingly, there appears to have been a change in settlement after about 3,000 BP. This shift was not one of settlement location, but rather was a shift in the functional use of specific sites. Prior to 3,000 BP, sites appear to have been general purpose, but after 3,000 BP, many became task specific. The

sites on top of the bluffs contained complex site structures, a diversity of features, and well-developed middens while those in the marsh areas contained thermal features and milling equipment but little evidence of habitation. Grenda and Altschul (2002:128), Stoll et al. (2003:16), and Altschul et al. (2005:285, 291, 295, 2007:35) suggested that this represented an "an influx of settlers" in the Ballona about 3,000 BP, probably Takic groups.

Another major change in settlement occurred when the Takic (proto-Gab/Cupan) occupied the southern Channel Islands. Before the Takic arrival, the occupants of these islands appear to have been independent of the Chumash on the northern Channel Islands or peoples on the mainland. When the Takic occupied the southern Channel Islands, connections with the mainland were formed, and settlement systems and patterns of resource procurement and use changed. Interestingly, steatite from Santa Catalina Island does not appear in the southern California record prior to about 3,000 BP (e.g., Koerper et al. 2002:69), suggesting that trade between Catalina and mainland southern California was not active prior to that time.

In interior southern California, the Millingstone phenomenon (the Sayles Complex) persisted until late in time (Kowta 1969). Sites of the Sayles Complex date to between 3,000 and 1,000 BP (Kowta 1969:50) and contain typical Millingstone assemblages. The settlement pattern of the Sayles Complex appears to be essentially the same as earlier Millingstone groups, with little to indicate any settlement pattern shifts until about 1,000 BP. This indicates that there was no population replacement or other major change in that region until at least 1,000 BP.

Subsistence Patterns

A change in subsistence patterns (e.g., different food preferences and patterns of resource utilization) would be expected if an immigrant population replaced an existing population. People occupying the southern California coast prior to about 3,000 BP were part of the Millingstone (the Encinitas Tradition) whose subsistence system was focused on plant collecting with the use of some marine resources along the coast, but with relatively little hunting (Warren 1968:6; but see Sutton 1993b).

Beginning sometime around 3,000 BP, the economic focus of mainland coastal peoples seems to have changed, with a general decrease in marine mammal and shellfish exploitation but with fish and terrestrial resources becoming more important. At about this same time, fishing appears to have intensified on the southern Channel Islands (see Raab et al. 1995:14). Altschul et al. (2007:37) suggested that these developments reflected a generally broader spectrum collecting strategy to coincide with more permanent settlements, perhaps heralding the entry of the Takic into the region.

An analysis of faunal exploitation at 12 sites in the Marina del Rey area spanning the last 8,000 years (Van Galder et al. 2007) revealed contradictory patterns. The general Millingstone pattern of focusing on terrestrial and littoral resources with modest use of pelagic fish and shellfish remained unchanged through the Intermediate Period (3,000 to 1,000 BP), although site functions did change through time (see above). Major changes in subsistence were documented for late prehistoric times, but this is too late to be relevant to the Takic problem. The meanings of these patterns are unclear.

It was proposed (Ciolek-Torrello and Douglas 2002) that immigrant Takic peoples, presumably from the Mojave Desert, may have been preadapted to marsh habitats and may have found the Ballona wetlands attractive. While it seems unlikely that Mojave Desert people would have been adapted to marsh habitats during the Middle Holocene (although some Great Basin groups may have been), it now seems that the

Takic came into southern California from the San Joaquin Valley, where marsh habitats were common, suggesting that the proposal by Ciolek-Torrello and Douglass (2002) may have some merit. Fishing, incidentally, was an important economic pursuit in the San Joaquin Valley during the Middle Archaic (Rosenthal et al. 2007:155).

Using isotope ratio data, Ezzo (2002:84-85) reported that the people on the southern Channel Islands focused on fish and sea lions while the people on the northern Channel Islands were more focused on fish, invertebrates, and birds, indicating that the inhabitants of San Nicolas Island were full-time residents and had relatively little contact with the mainland.

Summary of Evidence

It has long been clear from the archaeological record of coastal southern California that there were major changes sometime around 3,000 years ago. These shifts were sufficient enough that a new descriptive category, called either the Intermediate Period (Olsen 1930:17; Wallace 1955:221; Moratto 1984:125) or Middle Period (Moratto 1984:145; King 1990:93-94), was created to distinguish it from the preceding Millingstone Encinitas Tradition. The changes around 3,000 BP included new settlement patterns, new subsistence patterns, and an apparent population increase. That major shifts occurred throughout California at about this same time is suggestive of one or more large-scale causes, including political consolidations (e.g., King 1990:96), climate change, population movements, and transformations in shoreline environments.

Much of the evidence of cultural change in coastal southern California over the last four millennia does not, in isolation, support any particular causal factor. The biological evidence (discussed above) of a population replacement is, however, persuasive. It is clear that a biologically discrete population matching that of the Takic (Serran) Gabrielino replaced another biologically discrete population generally matching that of the Chumash on the southern Channel Islands about 3,200 BP. The date of the appearance of a Takic population on the mainland is not as well understood but must have been earlier than 3,200 BP, suggested herein to be about 3,500 BP, this view being in line with what is currently known from southern California, the San Joaquin Valley, and the western Mojave Desert. Following the model demanded by the biological data, each of the other data sets becomes convergent and concordant. The biological data further indicate that the groups now speaking languages of the Cupan sub-branch (other than Gabrielino) were not biologically replaced but adopted Cupan languages sometime after about 1,500 BP. As above, the other data sets are convergent and concordant with this argument.

The evidence outlined above supports the hypothesis that Takic peoples (proto-Gab/Cupan) from the southern San Joaquin Valley and/or western Mojave Desert entered coastal southern California about 3,500 BP and replaced Hokan (proto-Yuman?) groups along the Los Angeles and Orange County coasts. By 3,200 BP, Takic people occupied the southern Channel Islands, replacing peoples biologically similar to the Chumash. By about 1,500 BP, the Gabrielino language had become sufficiently distinct from its northern origins to be classified in a different branch of Takic (see Figure 4). About this same time, Gabrielino was adopted by a Yuman group to the south that would become the Luiseño, the basis of the Cupan sub-branch of Takic. About 1,000 BP, Kitanemuk diverged and was adopted by Yuman groups to the east, who then became the Vanyume and Serrano. At this same general time, Yuman groups to the east of the Luiseño adopted and modified the proto-Luiseño language, becoming Cahuilla and Cupeño, thus completing the Cupan sub-branch of Takic.

Succinctly, the Takic expansion into southern California is proposed as having been multiphasic. Phase

One was a southward migration of the ancestors of the Gabrielino, who then replaced a Hokan population. Phase Two involved the adoption of Takic languages by neighboring Yuman groups, who in the process emerged as the ethnographically known Serrano, Luiseño, Cahuilla, and Cupeño.

Causal Factors in a Takic Expansion

That Takic groups entered southern California at some point in the past has long been accepted, although the timing and causal factors involved were uncertain. If the analysis and conclusions presented above are correct, then the timing of the Takic expansion is largely resolved. The causal factors, however, remain at issue, and some possibilities are explored below.

It seems possible that NUA groups occupied a portion of the San Joaquin Valley as early as the Middle Holocene (e.g., Klar 1977:164; Shaul 1982:209-210; Moratto 1984:Figure 11.7; Eshleman and Smith 2003; Kennett et al. 2007). Linguistic reconstruction (see Moratto 1984:555; Golla 2007:75-80) suggests that sometime around 5,000 BP, Penutian groups migrated south from Oregon and occupied the northern Sacramento Valley, displacing and/or absorbing Hokan groups. Penutians then moved further south into the northern San Joaquin Valley by about 3,500 BP, impacting other Hokan, or even other NUA, groups (Moratto 1984:560; Kennett et al. 2007). It seems plausible that NUA groups (proto-Gab/Cupan) in the San Joaquin Valley were pushed south by the Penutians and responded to this pressure by migrating south into coastal southern California (e.g., Laylander 1985:51; also see Moratto 1984:571-572).

Because acorns probably became a major resource throughout California by about 5,000 BP (e.g., Moratto 1984), oak woodland areas would have been valuable resource locations. While there is currently no direct evidence, it is possible that coastal Chumash groups expanded east from the coast into interior regions (occupied by Takic peoples?) at about this time in order to gain control of prime oak territory (to become the Inland Chumash), forcing the Takic out of some of their territory. This pressure on the Takic, coupled with the Penutian pressure in the San Joaquin Valley, may have forced at least some of the Takic south into areas of less desirable oak territory (e.g., coastal southern California). Krantz (1978:64) proposed a similar argument, suggesting that "the acorn revolution" in northern California eventually reached the Takic Kitanemuk in the Tehachapi Mountains about 2000 BP, causing them to "overrun their neighbors for a considerable distance to the south."

Environmental factors have long been proposed for shifts in settlement and subsistence patterns in the western Mojave Desert. Sutton and his colleagues (see Sutton 1996:243-244; Gardner 2002, 2007; Allen 2004) have proposed that during Gypsum Complex times (ca. 4,000 to 1,800 BP), the western Mojave Desert was relatively warm and dry and that human populations based themselves at higher elevations in the southern Sierra Nevada/Tehachapi Mountains, exploiting the desert on an ephemeral basis. During Rose Spring times, the climate was wetter and cooler, and the settlement/subsistence patterns shifted, with people living in the desert on a permanent basis and using the highlands on a transitory basis. About 1,000 BP, the climate became warmer and drier once again (the Medieval Climatic Anomaly; see Jones et al. 1999; Gardner 2007), and the settlement/subsistence patterns reverted to the pattern of the Gypsum Complex.

Kennett et al. (2007:532-533) argued that environmental deterioration during the Middle Holocene induced the "spread of Uto-Aztecan peoples from the desert western interior [presumably the southwestern Great Basin/Mojave Desert] to the Southern California Coast" by about 5,000 BP. This idea is in keeping with earlier models of western Mojave Desert settlement (see above), but the dates appear to be too early

to conform with existing linguistic data (e.g., Hinton 1991:135; Hill 2001:928-929; Golla 2007:74).

Mechanisms of Expansion

The model of Takic expansion proposed in this article posits that a proto-Gab/Cupan population replaced an existing Hokan (proto-Yuman) population in the Los Angeles Basin ca. 3,500 BP and that by about 1,500 BP, Cupan languages began to diverge and diffuse eastward in a language (but not a population) replacement. Both mechanisms are discussed below.

Population Replacement

There are several ways that a new population can replace an existing one. If people living in coastal southern California abandoned the region, the Takic could have just occupied the area without encountering an existing population. There is no evidence, however, to suggest that coastal southern California had ever been abandoned, so this scenario seems unlikely.

Bettinger and Baumhoff (1982) argued that the Numic (also NUA) spread across much of western North America beginning around 1,000 BP by means of a more efficient adaptive strategy that included a technological advantage, seed beaters. Central to their model was the idea that there were two subsistence/settlement strategies involved, "a Prenumic strategy and a Numic strategy" (Bettinger and Baumhoff 1982:491) and that these strategies should have differed along the "dimension of dietary cost," primarily a difference in the relative reliance on large game and small seeds. A variation of this model might be applicable to the Takic case, although there has been no research regarding this possibility. Cochran (1965:87) proposed that desert groups were well adapted to arid regions and could outcompete groups that were not as well adapted; that is, desert groups moving coastward would replace coastal groups in times of drought.

In contrast to a dietary model, it is possible that warfare played a role. It has been proposed that hunter-gatherers are not militarily capable (e.g., Linton 1944), and Bright and Bright (1969:21) argued that the Takic replacement must have been peaceful since "it is not likely these people [the Takic], with their low-level desert economy, could ever have had any military power." Hunter-gatherers can employ military power, however, as shown by Numic populations expanding across western North America after about 1,000 BP (Sutton 1986).

In the San Joaquin Valley (part of the Takic homeland), violence was common throughout time (e.g., Ragir 1972:112; Rosenthal et al. 2007:160), suggesting that such violence may have been practiced by a Takic population from that region moving into coastal southern California. In southern California, however, there are few archaeological data on this issue. An analyses of burials from San Clemente Island suggest that violence was more prevalent before about 3,300 BP (Titus and Walker 2000:87; Potter 1998:12), suggesting that warfare was not a major factor in this population replacement.

Language Movement

The cephalic and cranial index data (Gifford 1926a: Table 7) indicate that the Luiseño, Cahuilla, and Cupeño are a biological population distinct from the Gabrielino. Following this line of evidence, it was suggested herein that the eastern Cupan groups were biological Yumans that adopted Cupan languages and that they have been in place for a long time, probably many thousands of years. If this is correct, then Cupan languages replaced Yuman ones through a process that must have been different than the population replacement by the proto-Gab/Cupan of the Hokan (proto-Yuman) groups along the coast.

Johnson and Lorenz (2006:35) proposed two scenarios of language replacement in prehistoric California.

The first is elite dominance, where an incoming group gains political control and imposes its language. The second is through intermarriage over an extended period of time, "leading to linguistically mixed communities that would shift from one language to another over several generations" (Johnson and Lorenz 2006:35). With regard to genetic data, both models would result in shared genetics. The existing genetic data appears to show intermingling between Takic and Yuman populations, a pattern consistent with the hypothesis that Cupan groups began as biological Yumans.

Some data, however, do not support this conclusion, suggesting a migration instead. For the mountain Luiseño, Strong (1927:19) reported that the lineage split every three generations, with one branch "moving away to a new territory and acquiring a new name." Strong (1927:20-21) also suggested that Cahuilla clans split every five generations, presumably also moving to new territory. Jane Hill (personal communication 2008) noted that Cupan languages were "very, very, Uto-Aztecan" and argued that Cupan languages did not appear to be a "second-language acquisition."

In addition, there is some ethnographic evidence hinting at the use of military force by the Cupan as a factor in language replacement. Hinton (1991:154) argued that "Cupan peoples spread their languages southward into Yuman territory through force and marriage . . . [and that] for each village, the Yuman language eventually disappeared, leaving only the changed Cupan language." Hinton (1991:154) further proposed that this pattern may have been employed for "many centuries."

A Model of Takic Prehistory

Out of the varied information presented above, there emerges a model of Takic prehistory. Its framework contains considerable gaps, yet there are testable provisions. The model is presented below in chronologically arranged sequences, after which are presented those expectations that follow logically from the model.

ca. 5,000 to 3,500 BP

Sometime around 5,000 BP, a generic NUA group occupied the western Mojave Desert, the southern Sierra Nevada, and perhaps the southern San Joaquin Valley. At roughly 4,000 BP, the branches of NUA diverged and occupied areas within the NUA region (see Figure 3). Takic was located in the western Mojave Desert and surrounding foothills (e.g., the Tejon Pass area) and a portion of the San Joaquin Valley. What would become the Inland Chumash, seeking to expand their oak territory, moved east toward the Tejon Pass area and pressured the Takic groups living there. By about 3,500 BP, southward-migrating Penutian groups pushed the Takic out of the San Joaquin Valley, perhaps with the help of the Chumash pressuring them in the Tejon Pass area.

ca. 3,500 to 2,500 BP

Beginning about 3,500 BP, the newly displaced Takic populations (the proto-Gab/Cupan) moved south into coastal southern California (Figure 8). It is not clear what role, if any, the Serran Kitanemuk and Tataviam played in a proto Gab/Cupan movement south. There is no evidence that the Kitanemuk moved, and the situation with the Tataviam is unknown. It is possible that proto-Gab/Cupan was originally in the San Joaquin Valley and shifted south into the Los Angeles Basin without any linguistic interaction with either the Kitanemuk or the Tataviam. In fact, there is reason to believe that the western Mojave Desert was sparsely occupied at that time (e.g., Sutton 1996:243-244).

When the proto-Gab/Cupan entered coastal southern California, they replaced the existing Millingstone (Hokan, proto-Yuman) populations. The biological signatures of the Takic were retained. Thus, it seems probable that the Hokan groups were either forced to

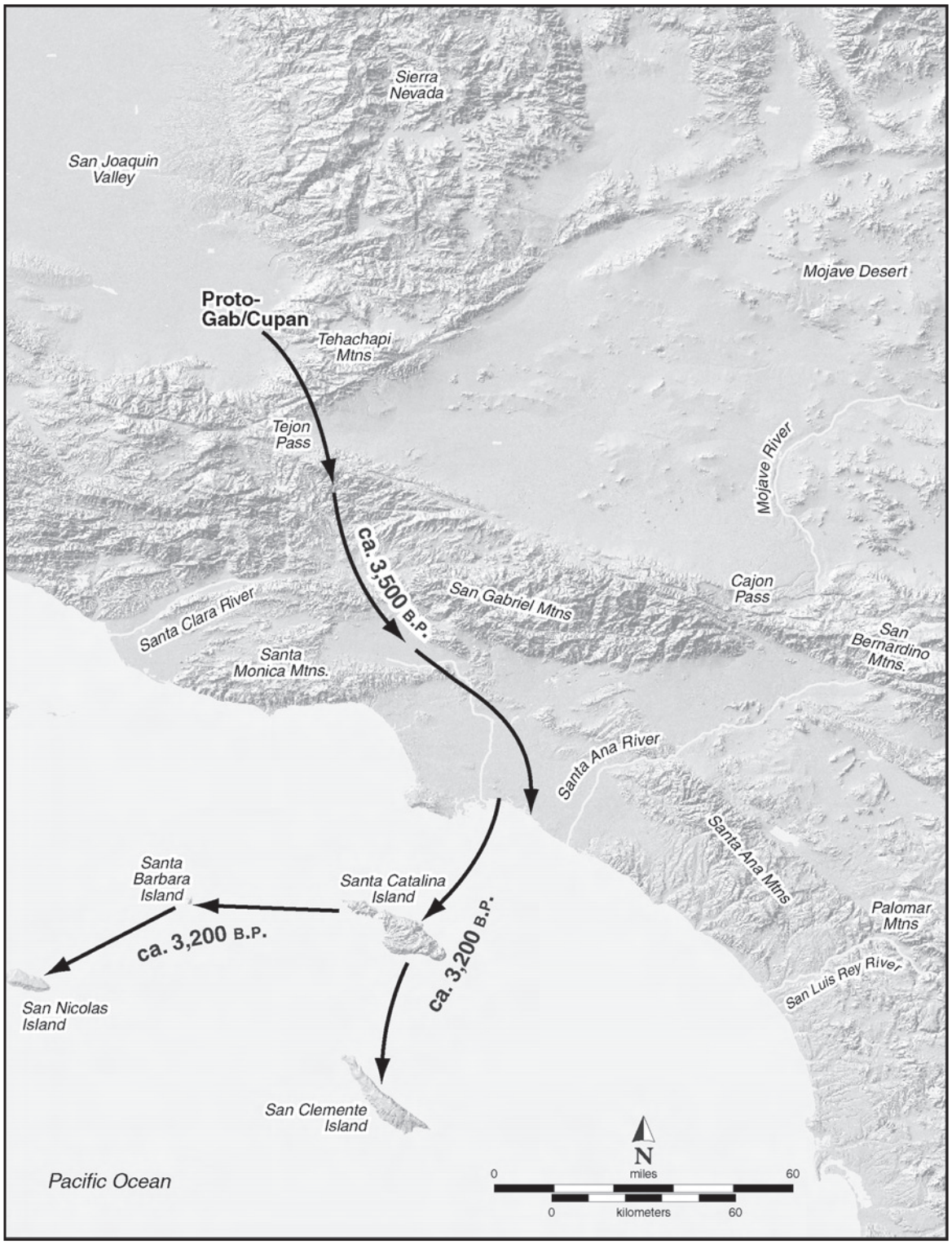

Figure 8. Hypothesized movement of the proto-Gab/Cupan into coastal southern California ca. 3,500 BP and onto the southern Channel Islands ca. 3,200 BP.

move south or east or were eliminated. Millingstone (Hokan) groups in the interior of southern California were also impacted by the Takic arrival, being cut off from the coast and perhaps forced to accommodate refugees from the coast. A relic Millingstone group (Topanga III) may have survived in the Santa Monica Mountains until close to 2,000 BP (although Leonard [1971:123] thought that Topanga III lasted until ca. 500 BP).

Once along the coast, the proto-Gab/Cupan quickly adopted a subsistence system that emphasized fishing and terrestrial resources, perhaps "borrowing" traits from the neighboring Chumash (Warren 1968:9). Within a few hundred years, by about 3,200 BP, the proto-Gab/Cupan pushed out onto the southern Channel Islands (Figure 8) and replaced the biologically Chumash-like populations there. Takic had apparently been in contact with Chumashan for some time (Klar 1977, 2008), and the abundance of trade items from the coast (mostly beads and steatite) in the archaeological record of the western Mojave Desert suggested to Sutton (1980, 1988, 1996) that Takic groups in that region had developed significant trade relationships with the Chumash by at least 3,000 BP, although that date is now thought to be closer to 2,500 BP. There is little to suggest that the Takic and Chumash ever had a hostile relationship, although it is possible that the Inland Chumash took some Takic territory thousands of years ago. There is no reason to believe that the southern Channel Islands were occupied by people sociopolitically associated with the Chumash proper, and so the Takic takeover of the southern Channel Islands probably did not impact Takic/Chumash relations.

ca. 2,500 to 1,500 BP

Near the midpoint of the third millennium BP, proto-Gab/Cupan had sufficiently differentiated to become proto-Gabrielino, and new traits appeared. Cremation began to be practiced, and large mourning features incorporating cremated human remains appeared at some sites. Similar features are known in Chumash territory (e.g., Greenwood et al. 1986; Raab 1994; Martz et al. 1995), date to later times, and may be borrowed Yuman traits.

As discussed above, the settlement pattern of the western Mojave Desert changed dramatically ca. 2,500 BP. This is too late to have been a factor in the initial Takic expansion to the south, but it may be related to a later expansion of trade and influence from the coast back to the homeland. It has always been generally assumed that the coastal trade materials found in western Mojave Desert sites originated with the Chumash (and no doubt some did), but it now seems possible that some of the trade materials came from the proto-Gabrielino. The steatite typically assumed to be from the Channel Islands may have originated from the Sierra Pelona schist source in the Transverse Ranges (see Rosenthal and Williams 1992). The Chumash may have had little to do with western Mojave Desert trade and thus had little interaction with Takic groups.

A Takic Interaction Sphere?

The movement of large quantities of trade goods from the southern California coast north to the Mojave Desert, then north into the Great Basin and east to the Southwest may have begun after the appearance of the proto-Gabrielino. The preceding Millingstone groups on mainland southern California possessed few shell beads and no artifacts of Santa Catalina Island steatite. After ca. 3,000 BP, these materials began to appear in the archaeological record. It seems that the proto-Gabrielino may have initiated a substantial upswing in trade that resulted in the formation of an interaction sphere involving the proto-Gabrielino and their brethren in the western Mojave Desert, which is located in a strategic geographic position with respect to trade and contains several major aboriginal trails (Farmer 1935; Sample

1950; Davis 1961). Evidence suggests that western Mojave Desert groups were heavily involved in trade activities (particularly of shell beads and obsidian) and were not just passive observers (Sample 1950:5; Robinson 1977).

Sutton (1989b) proposed the existence of three late prehistoric (ca. 1,000 BP) interaction spheres in the Mojave Desert, with boundaries that generally matched the geographic distribution of the ethnographic groups. The northern sphere (Numic territory) was characterized by both Desert Side-notched and Cottonwood projectile points, brown ware ceramics, some buff ware near the Mojave River, and obsidian obtained mostly from sources to the north (primarily Coso, but including material from Nevada, the Owens Valley, and some from Obsidian Butte far to the south). The eastern sphere, generally matching Hakataya (Yuman) territory (with a late veneer of Numic materials), was characterized by the presence of both brown and buff ware ceramics, a dominance of Cottonwood projectile points (the Desert Side-notched type being rare), and the exclusive use of local obsidian sources. The western sphere (Takic territory) was characterized by Cottonwood points, few ceramics of any kind, cemeteries, and a very different settlement pattern than the rest of the Mojave Desert. It is possible that the western sphere identified by Sutton (1989b) in the Mojave Desert is the northern aspect of a larger Takic interaction sphere that encompassed much of southern California (Figure 9).

ca. 1,500 to 1,000 BP

The Gabrielino language diffused south into a neighboring Yuman group and was altered sufficiently to become a separate language. This new language (proto-Cupan) would have served as the founder of the extant Cupan languages (Luiseño, Cahuilla, and Cupeño) and so must have been "in place" prior to the development of the languages of the Cupan subbranch at about 1,000 BP. This process would have begun with the a group that would later become the Luiseño adopting a derivation of Gabrielino (proto-Cupan) at perhaps 1,500 BP (Figure 10) , the timing of which is estimated to provide enough time for language dispersal prior to ca. 1,000 BP. The arrival of bow and arrow technology into Orange County at about that same time might be related (e.g., Koerper et al. 1994, 2002:63-64).

ca. 1,000 BP to Contact

By about 1,000 BP, proto-Cupan diverged into Luiseño and proto-Cahuilla-Cupeño, the latter diffusing east (Figure 11), adopted first by the Cahuilla and then quickly by the Cupeño. Thus, the eastern languages of the Cupan sub-branch of Takic developed within the last 1,500 years or so (see Golla 2007:75), initially by the Luiseño, then followed by the Cahuilla and Cupeño.

At about this same time, the Kitanemuk language diverged and diffused east (Figure 11), adopted first by a Yuman group along the Mojave River (to become the Vanyume) and then by the Yumans occupying the San Bernardino Mountains (to become the Serrano). Before 1,000 BP, both the Vanyume and Serrano were Millingstone peoples of the Sayles Complex that had been isolated from the coast by the initial Takic movement south at ca. 3,500 BP. The adoption of derivations of the Serran Kitanemuk may have served to integrate these groups into the larger Takic interaction sphere.

Several factors may be related to the eastward expansion of the Serran and Cupan language groups. First, it seems that the inland Millingstone (Sayles Complex) groups appear not to have adopted bow and arrow technology until about 1,000 BP, 500 years after the neighboring Gabrielino. The reasons for this are unclear, but the diffusion of such technology east may be related to the movement of Takic languages. Second, Takic may have moved

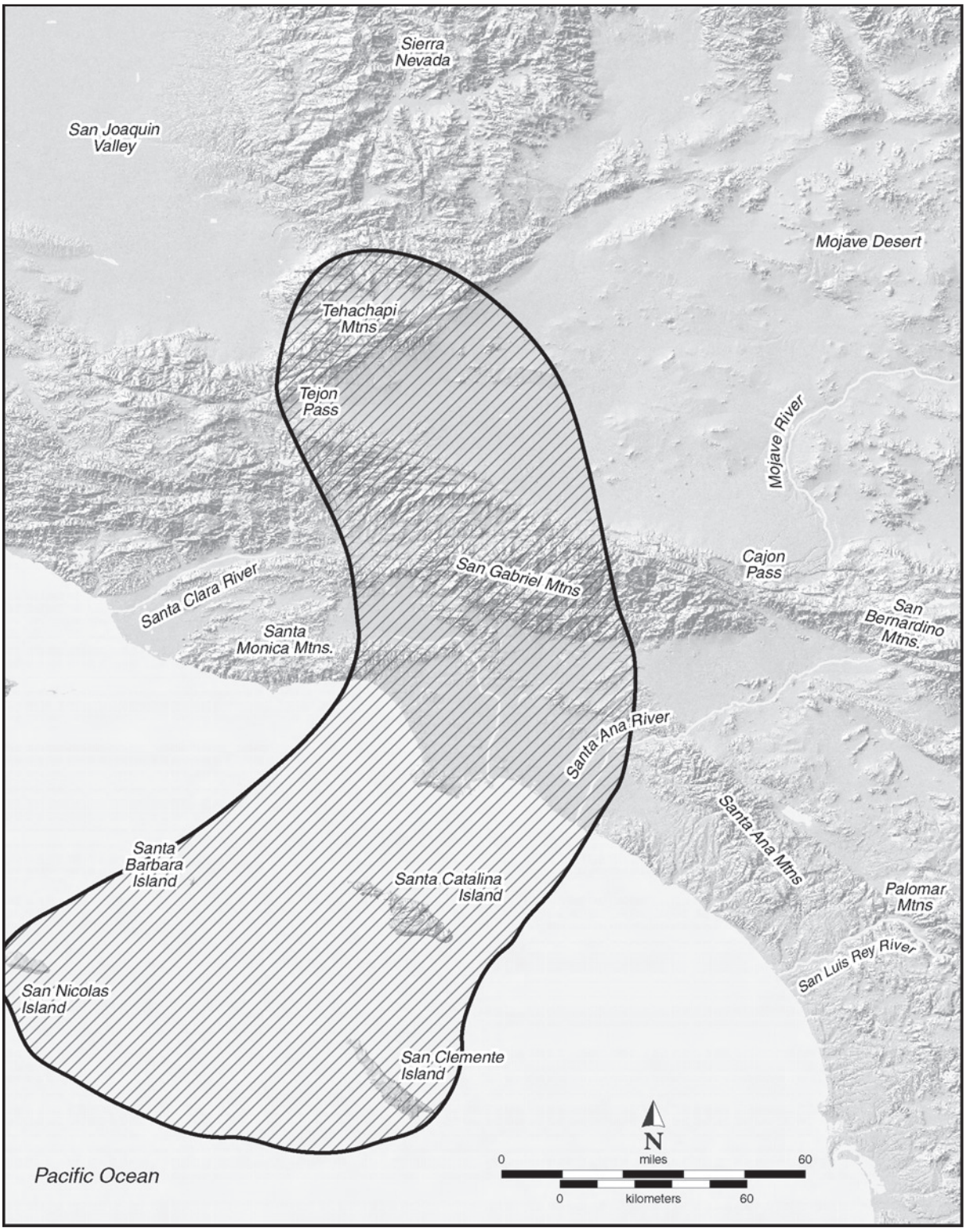

Figure 9. Proposed extent of the hypothetical “Takic Interaction Sphere” (shaded) in southern California, beginning ca. 2,500 BP.

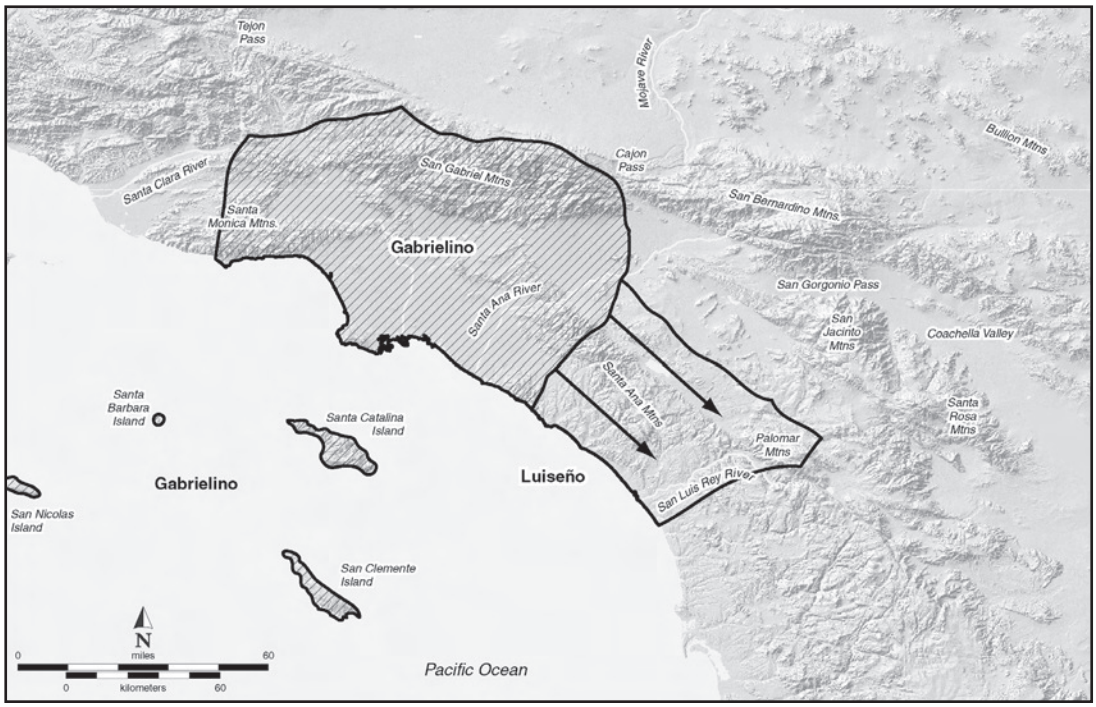

Figure 10. The proposed movement of proto-Luiseño from Gabrielino ca. 1,500 BP.

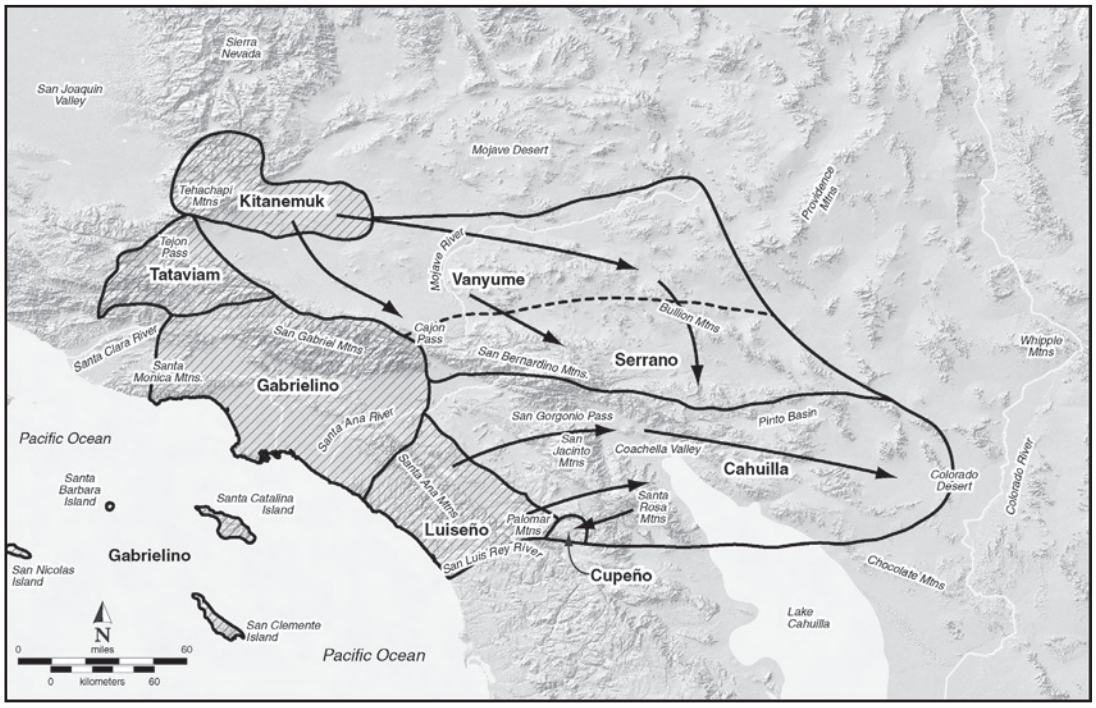

Figure 11. The proposed movement of Takic languages into Yuman groups (that would become the Vanyume, Serrano, Cahuilla, and Cupeño) about 1,000 BP.

eastward as a result of environmental conditions, as the Medieval Climatic Anomaly occurred at about this same time (e.g., Gardner 2007). Third, a major stand of Lake Cahuilla (Figure 2) occurred about 800 BP (Laylander 1997:68; Schaefer and Laylander 2007:250) and would have served as a major attractant to populations in and near the Peninsular Ranges of southern California. The fluctuations of Lake Cahuilla have long been viewed as central to population movements into and out of the Salton Basin (e.g., Wilke 1974:27, 1978; Waters 1983; Sutton 1998) and, as first suggested by Cochran (1965:87; also see Laylander 2007), may be related to the Takic movement east (specifically the ethnogenesis of the Desert Cahuilla as they moved east into the northern Coachella Valley).

The evidence regarding causal factors in the movement of Cupan languages discussed above is circumstantial, based only on the timing of events. Finally, based on hints in the ethnographic record, it is possible that the Takic expansion was still moving south and east very late in time and was halted by European contact.

Linguistic Expectations of the Takic Model

If the Takic expansion unfolded as outlined above, there are several testable linguistic expectations (see Figure 12). The Gabrielino language should have become distinct after ca. 3,500 BP and should be more distantly related to the Serran languages. Second, Serrano should be a daughter of Kitanemuk (diverged ca. 1,000 BP) and should retain links to its original Yuman substratum, which would be closer to the Colorado River Yumans than to the southern California Yumans. Luiseño would have diverged from Gabrielino sometime about 1,500 BP. After about 1,000 BP, the other Cupan languages diverged from Luiseño (see Figure 12). All of the Cupan languages should retain links to their original Yuman substratum, which should be close to the other southern California Yumans (e.g., Ipai).

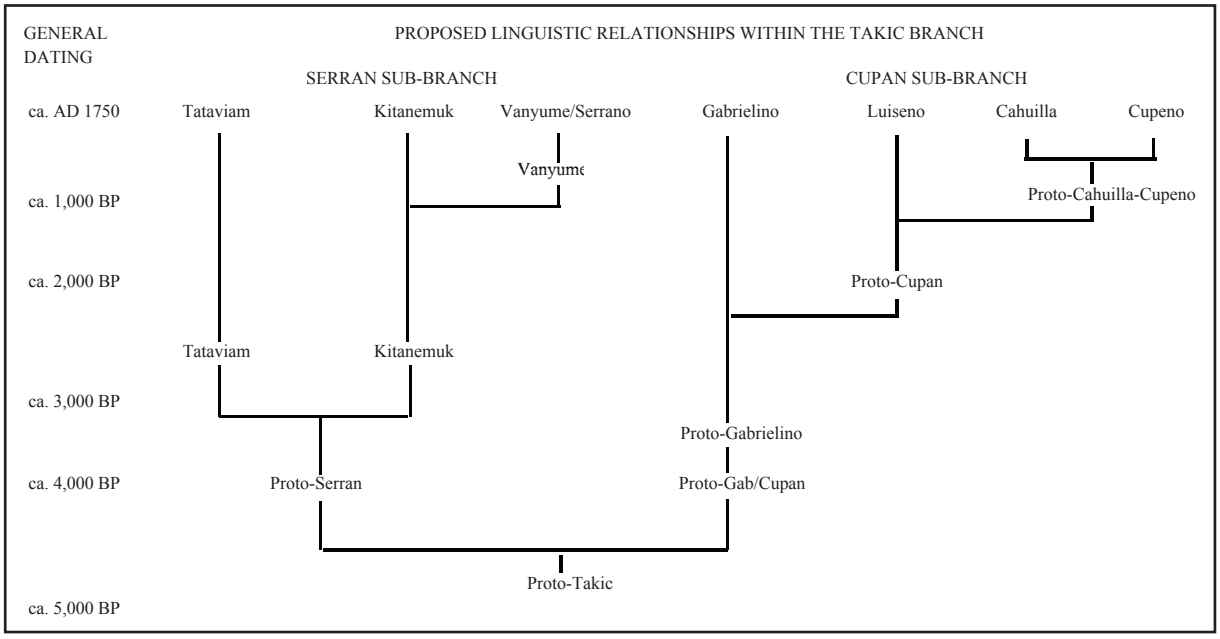

Figure 12. A model of linguistic relationships within the Takic Branch of Northern Uto-Aztecan, with proposed time frames for differentiation.

Each of these expectations would require that the linguistic data be reexamined with a premise of Cupan language replacements of Yuman languages. To date, no such examination has been conducted by linguists.

Biological Expectations of the Takic Model

The model employs biometric data, but sample size and gaps in geographic coverage continue to be problems. If the model is correct, it is predicted that the cranial indices of prehistoric Kitanemuk, Tataviam, and Gabrielino groups (biologically Takic) will be less than 75, the Western Mono signature. The other ethnographic Takic groups (Luiseño, Serrano, Cahuilla, and Cupeño) have a Californian cephalic signature (≥80), and it is predicted that prehistoric populations in those areas would also have a Californian cranial index signature. Along the coast of southern California, archaeological populations would have a Californian cranial index signature of ≥80 prior to ca. 3,500 BP and a Western Mono cranial index signature of ≤75 after 3,500 BP (after 3,200 BP on the southern Channel Islands). In the western Mojave Desert, the cranial index signature would be the Western Mono type through at least the last 5,000 years. In the San Joaquin Valley, the Western Mono type would have been replaced by the Californian type (the Penutians) sometime before 3,500 BP.

Archaeological Expectations of the Takic Model

When the initial Takic group arrived in coastal southern California about 3,500 BP, they would have brought with them a variety of new traits. These would have included a more terrestrial economic focus, the use of lithic materials from the north (e.g., Coso obsidian and steatite beads from the Sierra Pelona), and a mortuary pattern that included primary, flexed inhumations. Occasional cremations, along with mourning features, diffused in from the east after about 2,500 BP.

The proto-Gabrielino would have developed strong trade relations with the neighboring Chumash and expanded this trading network north with their Takic brethren, forming a "Takic Interaction Sphere." Abundant shell beads and Santa Catalina Island steatite should not be found in southern California mainland sites predating 3,500 BP. Obsidian sources should be dominated by Coso until about 1,000 BP, when that trade was disrupted by events in the Mojave Desert (Sutton et al. 2007:242).

Inland southern California was occupied by proto-Yuman, Sayles Complex groups before ca. 1,000 BP. This region was sparsely occupied; groups generally had low populations, and they were very insular (e.g., did not adopt the bow and arrow until ca. 1,000 BP). Cremation, a Yuman trait, was an important mortuary practice and should be much more common than along the coast. Lake Cahuilla would have been a major population attractant, but the major occupations would have occurred after ca. 1,000, subsequent to the arrival of Takic influences. Portions of the southern extent of historically known Luiseño territory may have been held by Yuman groups (e.g., La Jolla III?) until replaced by a very recent Luiseño expansion south (identified in the archaeological record as the San Luis Rey Complex; see True et al. 1991).

Concluding Remarks

After decades of debate, a comprehensive model of a multiphasic Takic expansion has emerged. The date of the beginning of the Takic expansion at about 3,500 BP was deduced by some previous researchers (Kowta 1969; King 1981:326-327; Moratto 1984:165; Gamble and Russell 2002:123), and the possible role of the Penutians in pushing the Takic south was anticipated by Laylander (1985:51). The osteometric work of Kerr (2004) and others solidified the arguments of population replacement and formed the basis for many of the arguments presented herein. The final constituent to the Takic expansion model was the proposition that

the Cupan groups were biologically Yuman peoples who had adopted Cupan languages sometime after about 1,500 BP. This last ingredient fits with what is currently known about the genetics and archaeology of the Cupan regions and completes the model.

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